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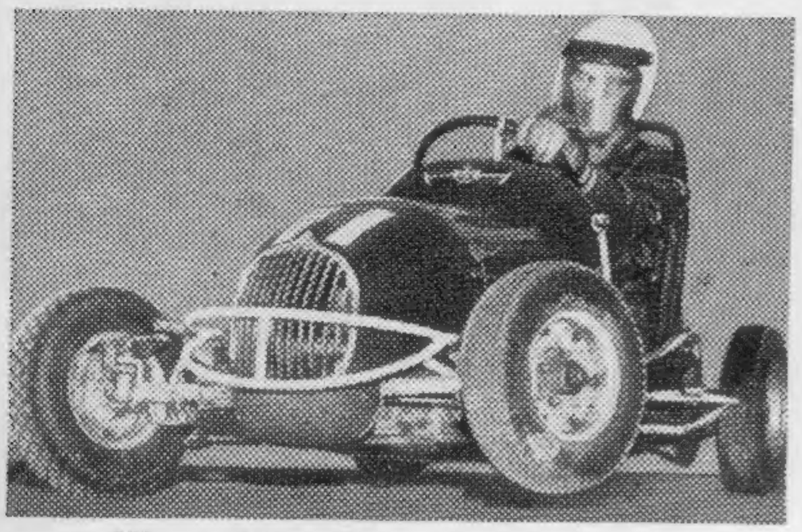
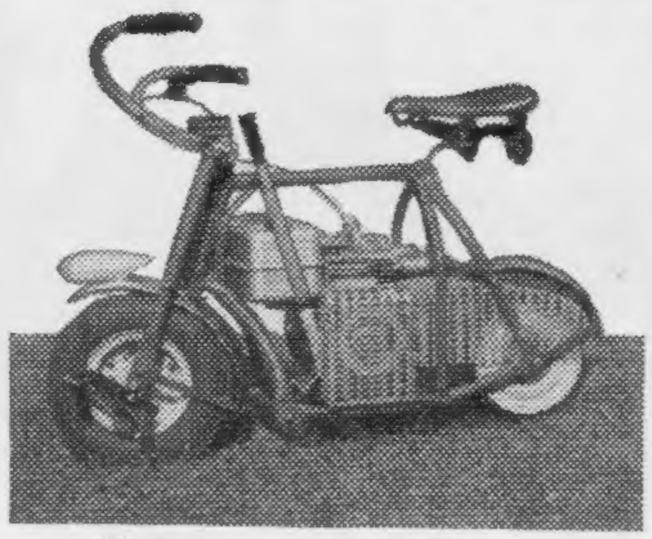


Micromidget Race Car—No. 293
Built by: Vernon Hunt
Kenesaw, Nebr.



Powercycle—No. 215
Built by: Alfred Coretti
1022 Belmont
Utica, New York

Folding Camp Trailer—No. 200
Built by: Ludger Dupius
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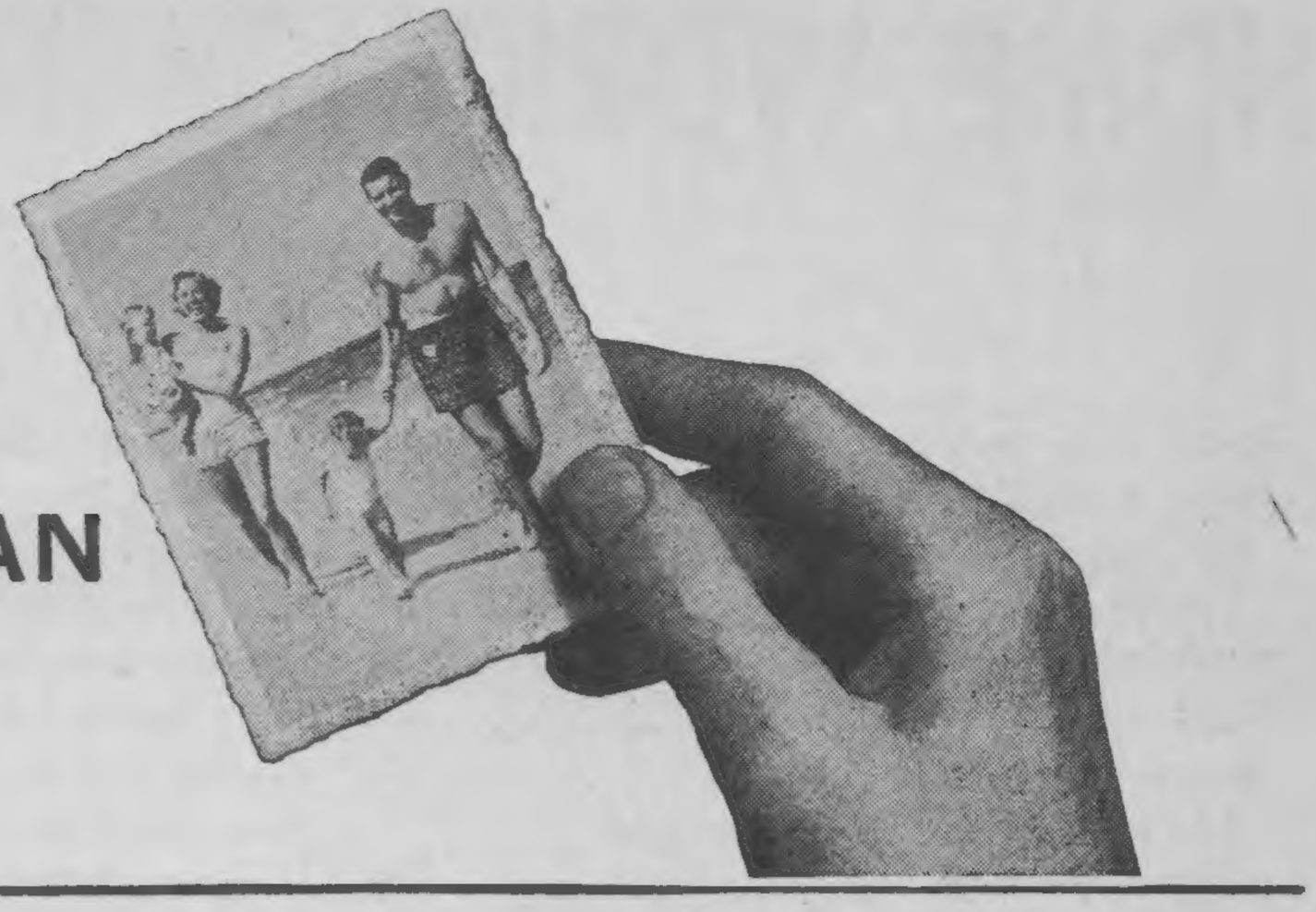

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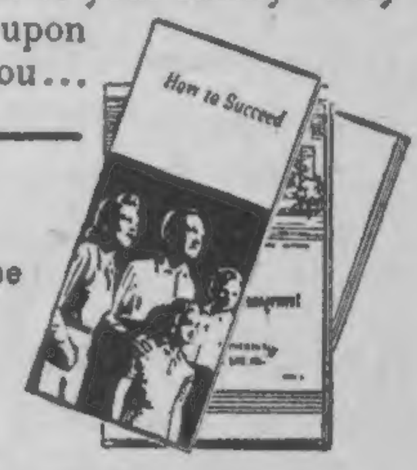

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1962 EDITION

B. G. DAVIS
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JOEL DAVIS
Assistant Publisher

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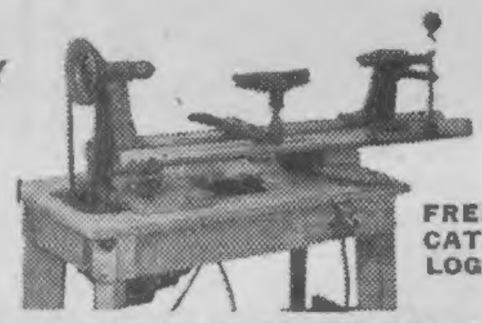

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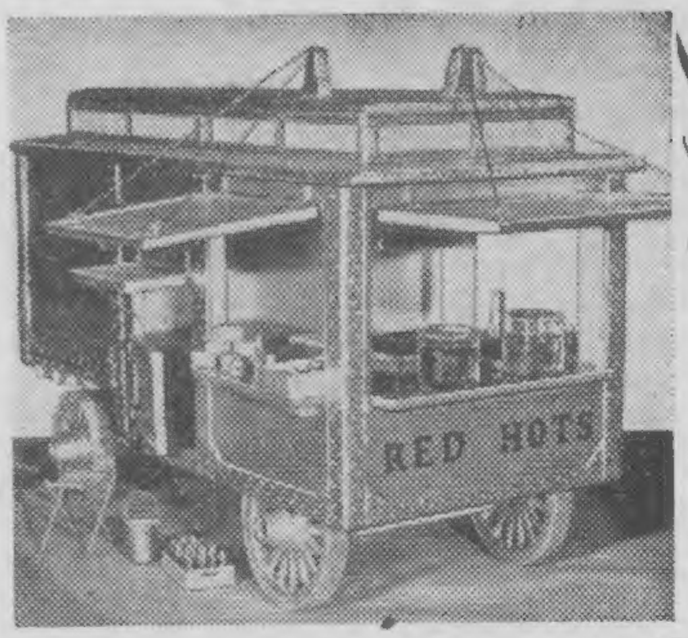

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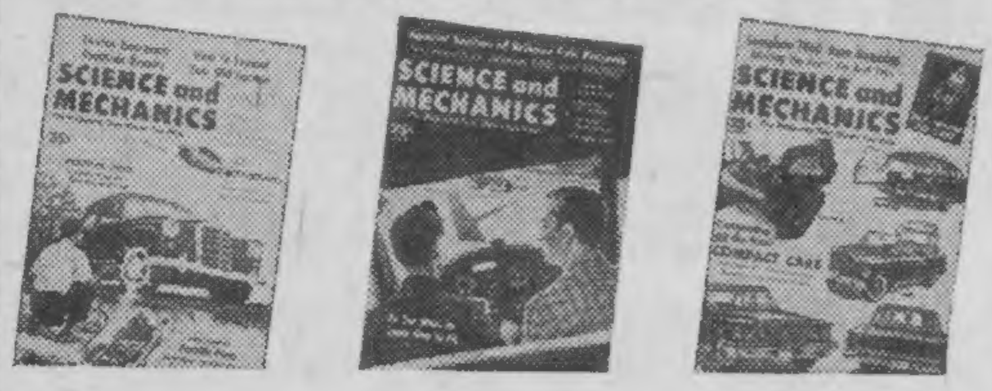

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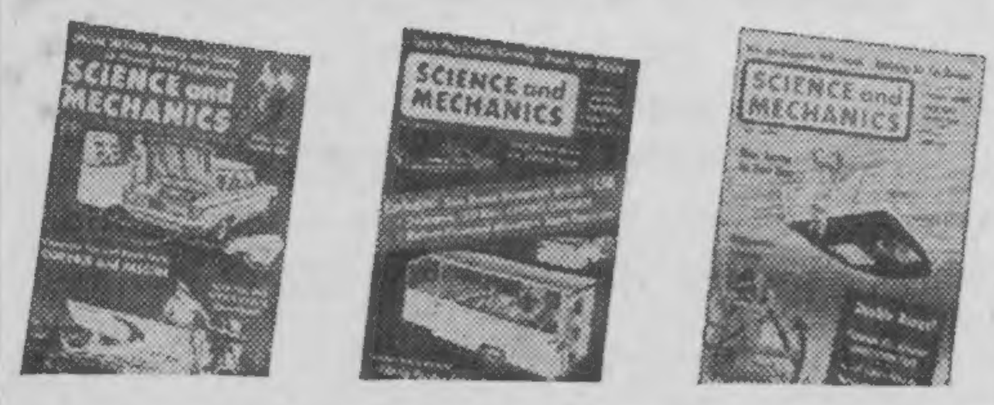

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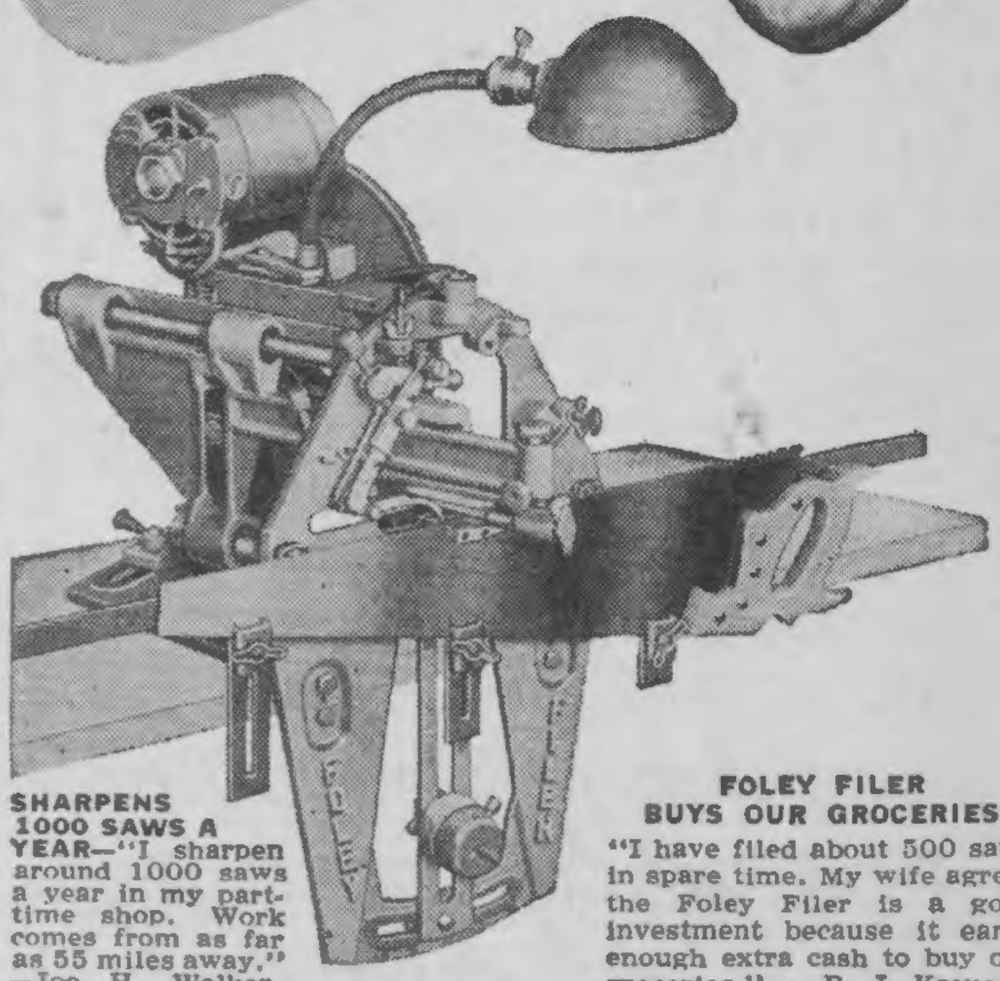

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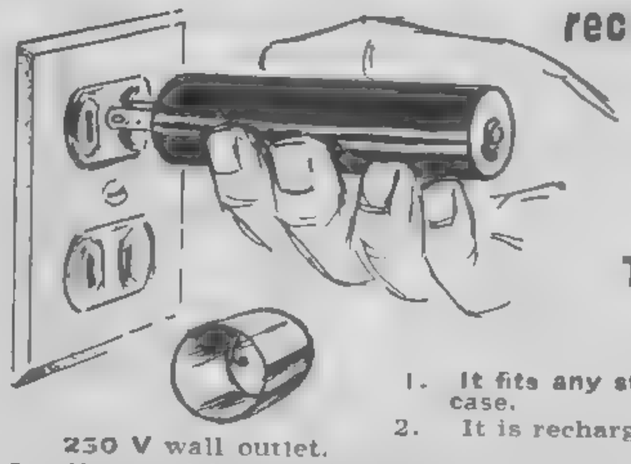

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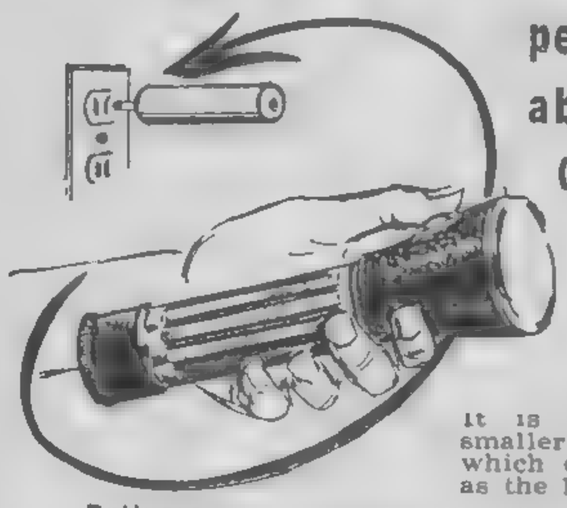

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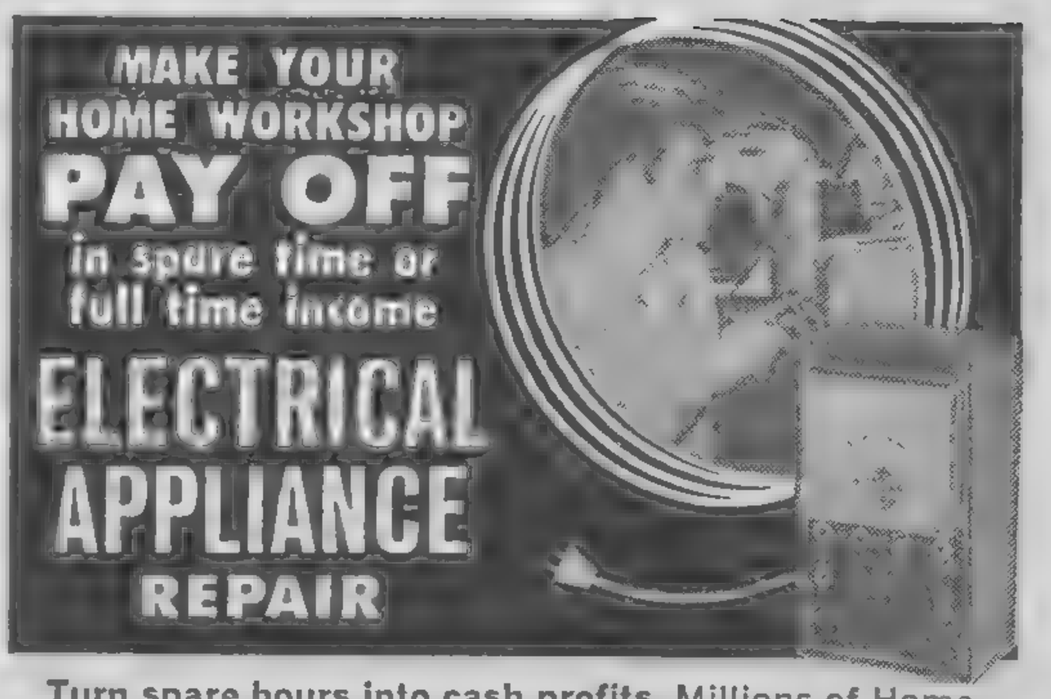

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(Advertisement)

A number of one-man mail order enterprises are paying their owners an income of $40,000 to $50,000.

SPECIAL OPPORTUNITIES

Mail order is big business. Annual catalog sales volume of Sears, Roebuck and Co. is over 700 million dollars!

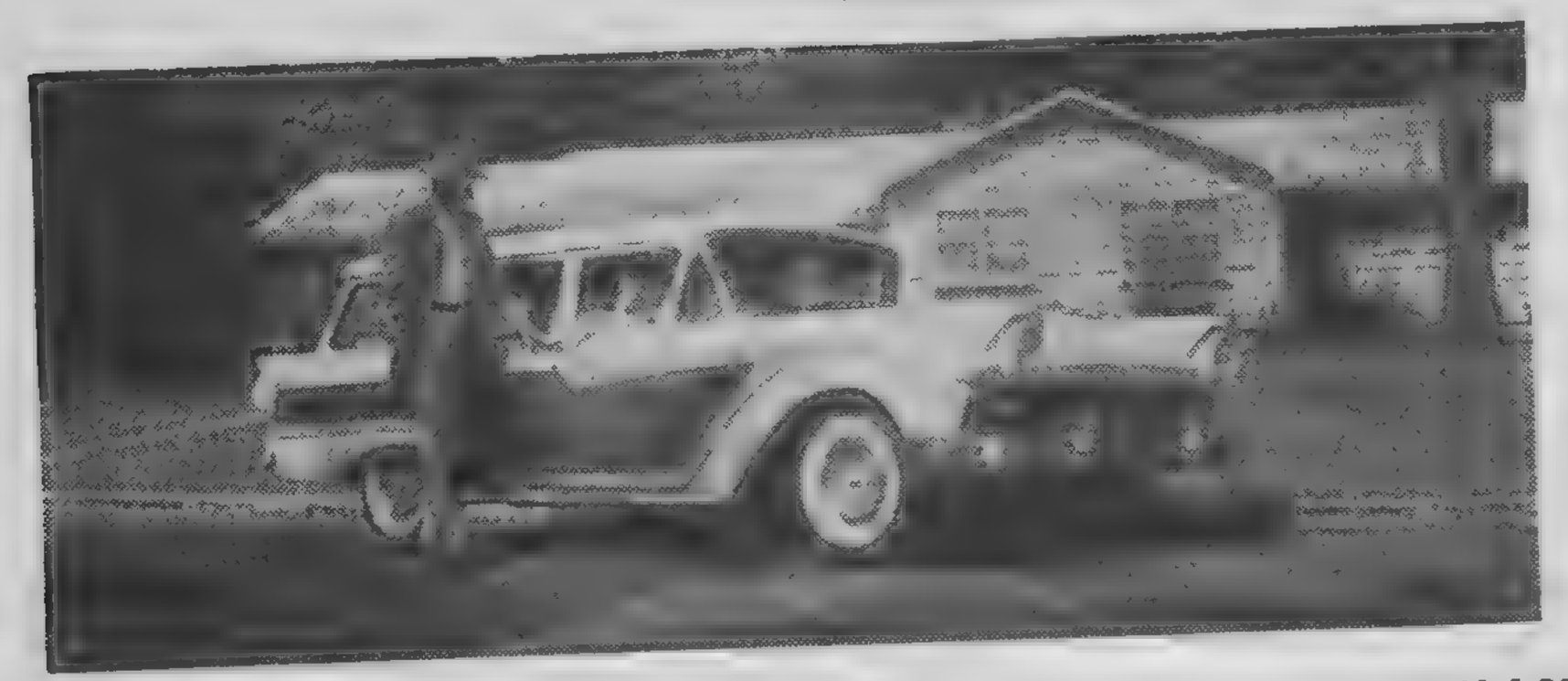
HOW TO START

Your Own Mail Order Business

You can make a fortune by mail. New firms will set you up in a fabulous mail order business of your own! They'll make up your catalogs, prepare your advertising, supply mailing lists and even ship your products for you!

By Robert Stevenson

When Anthony Sambati injured his back and was laid off from work he never dreamed it would be a blessing in disguise. Bedridden for weeks, he decided to start a small mail order business. This was something he could run right from his own home and required very little capital to begin. In fact, Sambati started with less than $85.00.



After a short time in mail order, Sambati soon had a beautiful home with all the luxuries of a successfulbusinessman.

He figured that a small mail order business might provide a temporary income to support his family until he got back on his feet. His first step was to obtain a franchise from a large wholesale mail order firm which supplied him with all the necessary catalogs and mailing literature. It wasn't long until his spare-time venture blossomed into a booming enterprise. Drawing a small salary and pouring the rest of the profits back into the business, he soon had others working for him! Today he owns a large retail store, his own warehouse and a beautiful home with all the luxuries of a successful businessman.

Sambati's story is typical of a number of men and women who began a small mail order business with absolutely no previous experience, and made a huge success of it. These 'little' people are quietly pocketing big profits every day—many content to keep the business small . . . spending an hour or two each day in the privacy of their own home. No bosses, time clocks or small pay envelopes. No door to door selling, in fact, you never even meet your customers face to face.

Yes, a small one-man mail order business is ideal for anyone wanting a chance to gain financial security and independence. Yet thousands try mail order each year and fail, simply because they don't learn the few simple secrets of success early in the game.

Take the case of Bud Sheer who had been working for a theatre in a small New Jersey town. With only a few hours spare-time to spend each morning, he tried mail order to supplement his regular income. Like many beginners in this field, Sheer was faced with the problem of finding good mail order items which would have a high mark-up and repeat sales potential. But the biggest obstacle was the expense of printing a catalog.

Then he heard about the A. J. Statile Co. of Hillsdale, New Jersey—an organization set up to aid the small mail order beginner.

He wrote to A. J. Statile Co. for full information, sent in his application for a franchise and within a short time the cash began rolling in. Today Bud Sheer *owns* the theatre he once worked for. Sheer attributes his success in mail order to the A. J. Statile Co. Actually, the theatre he owns has become a side investment. He still uses the beautiful 300 page mail order catalogs supplied by A. J. Statile Co.

How does the Statile Co. help the beginner get a sound start in mail order? Very simply. Just as Henry Ford made automobiles within the reach of the general public—by mass production and large volume.

Let's take a few specific examples:

(1) All franchised dealers of A. J. Statile are offered ready to mail catalogs and sales literature. Each mailing piece has the dealer's name and address printed right on it. By printing millions of catalogs, Statile is able to offer these at a fraction of their regular cost. The artwork and layout costs for these catalogs would run into thousands of dollars for the beginner if he were starting from 'scratch'.

(2) Since all mailing material and catalogs contain your name and address, all orders come directly to you. Yet you don't have to invest one penny in inventory. All merchandise is stocked for you. In fact Statile has over $3 million dollars worth of mail order merchandise at your disposal.

(3) All packaging and shipping is done for you. You simply send a shipping label to Statile together with the wholesale cost of the items, and the merchandise is shipped directly to your customers under your own shipping label.

(4) A consultation service is provided to answer any questions you may have. You receive a secret list of over 100 national magazines which run free ads. You'll be shown how to obtain free publicity on your own mail order items. In addition, you obtain trade names and addresses of over 150 other mail order wholesalers who drop-ship top mail order items for you. You'll also be given all the government laws and regulations pertaining to a home operated mail order business. These laws are a 'must' for all beginners.

All this valuable information is covered in the Statile Mail Order Survey which every new franchised dealer receives from Statile before they begin. Formerly sold for $25.00, this survey has become the 'bible' of the trade. Mr. J. M. of Baltimore, Md., writes, "To tell the truth, all the information in regard to obtaining free ads is alone worth the $25.00 I paid you . . ." J. D. of Kalamazoo, Mich.,

states, "Just a personal note to say I am most satisfied with my $25.00 investment. Your sales plan is simple and well organized . . ." These are only a few of the many testimonials received praising the Statile Mail Order Survey.

(5) The catalogs and mailing literature offered by Statile Co. cover every conceivable mail order item. You select the field you are interested in . . . BABY ITEMS, TOYS, APPLIANCES, VITAMINS, BOOKLETS AND

The thrill of receiving money in your morning mail is one you'll never tire of.

MAIL ORDER COURSES, you name it, Statile has the catalog or mailing piece. Select your market, order your mailing literature and you're in business.

(6) You'll be told how to compile your own mailing lists—and this is the most important part of your business. Many a beginner has fallen by the wayside simply because he mails his catalogs to a poor list of names. Suppose, for example, you offered a beautiful scale model of a 40′ Chris-Craft cabin cruiser by mail. You would probably make your mailings to boating enthusiasts and the chances are that nine times out of ten your mailings would show a loss instead of a profit. How would Statile help you solve this particular mailing list problem? He would show you where to get the names and addresses of *actual owners* of 40 foot Chris-Craft cabin cruisers! Surely every owner would like to have a scale model of his own boat. Strange as it may seem, such a mailing list is available to anyone. The secret is where to find it. This is just one example of how an experienced mail order expert giving you personal advice, may mean the difference between success and failure!

This same method of obtaining selective specialized mailing lists may be applied to practically any market . . . selling baby items to new mothers, selling toys to young children, etc., etc.

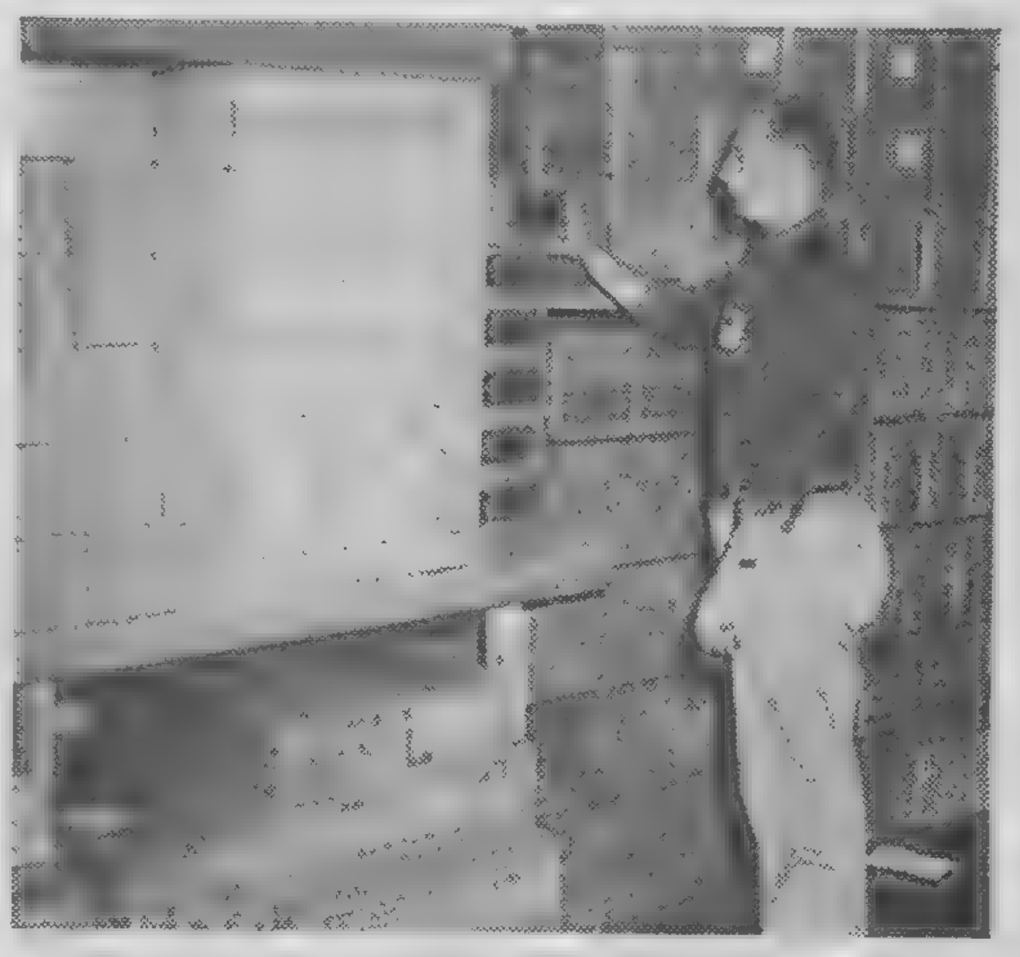
So much for starting your own mail order business. Now, a word of caution. OBTAIN YOUR MAIL ORDER FRANCHISE FROM A REPUTABLE MAIL ORDER FIRM. Unfortunately, during the past few years a number of ads have appeared in newspapers and magazines offering to start people in mail order. The ads are grossly misleading. Many imply that you can become a millionaire over night if you use their catalogs. Beware! Particularly if they operate their own mail order business direct to the consumer. These firms compete with their own franchised dealers! They could just as well mail all the catalogs themselves. They don't need you.

Other shady firms fail to drop-ship your orders promptly, thereby losing customers for you. In mail order, prompt shipment is an absolute requirement for a successful operation.

Deal only with firms whose business is preparing catalogs and shipping merchandise. They operate on a strict wholesale basis for franchised dealers exclusively. Such a firm is the A. J. Statile Co. Letters from successful franchised mail order dealers speak for themselves. A woman from Milwaukee writes, "It has been better than my expectations." A gentleman from California states "we are quite pleased with the response we are receiving." Another man from Wisconsin writes, "To say the least, I am more than satisfied."

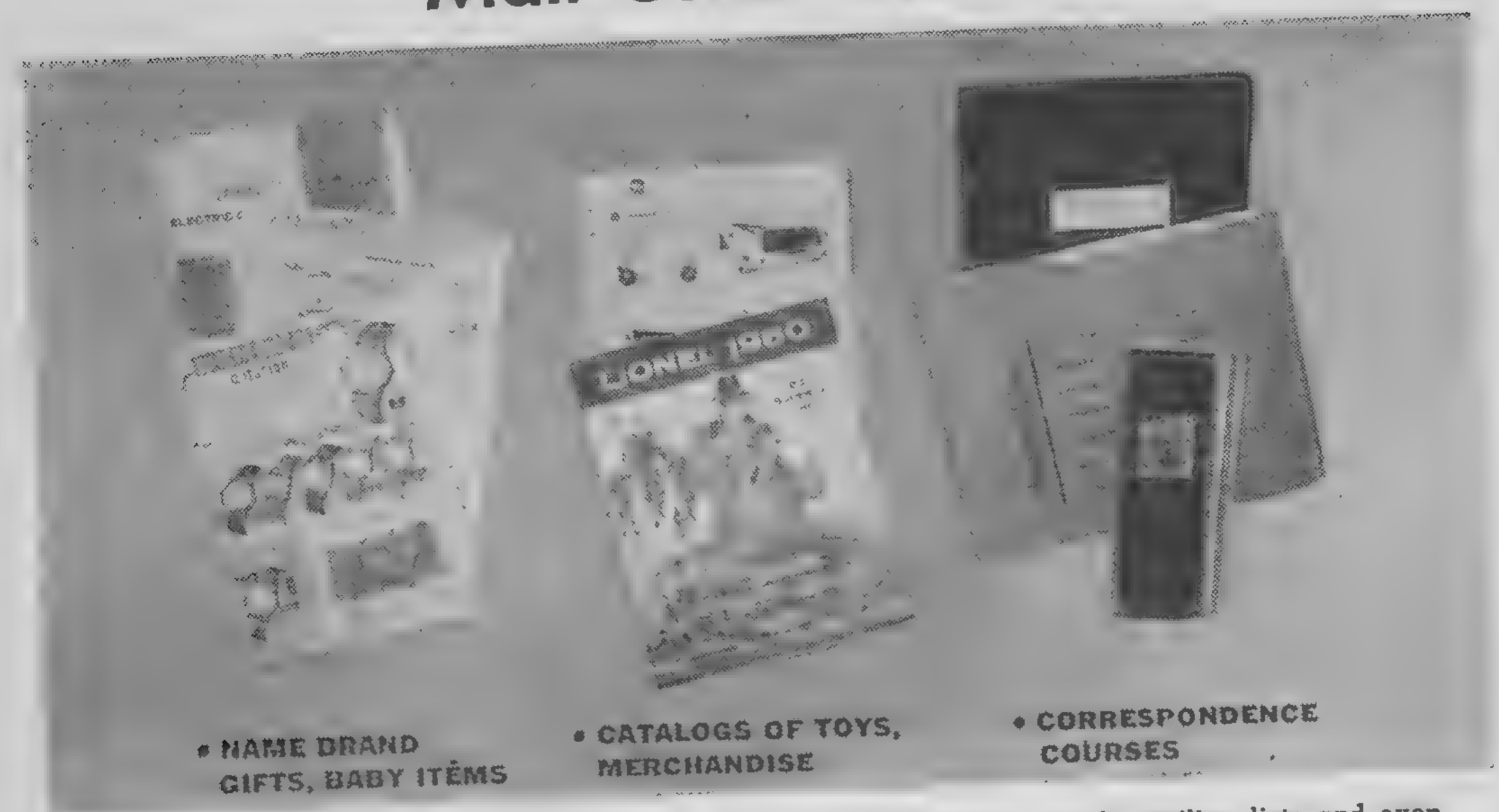
Yes, a small mail order business offers you an opportunity to earn a second income, or—if you work at it in earnest, a chance to strike it rich. The young housewife in St. Louis may be content to make an extra $20.00 a week . . . the office worker in Los Angeles may be aiming for $150.00 weekly full time business . . . and the ambitious schoolteacher in Newark may reach $20,000.00 a year. What is your objective? Set your own goal, pick your own hours, and the sky is the limit.

Even a government report stated that a number of the most successful one-man mail order enterprises make as high as $40,000 to



Big firms will carry all stock for you. They ship orders direct to your customers using your own shipping labels.

Your Own Catalogs of Top Mail Order Items!



A. J. Statile Co. will prepare your catalogs, write your sales letters, supply mailing lists and even ship merchandise for you, using your own shipping labels!

$50,000 a year! But frankly, this is the exception rather than the rule. Most mail order operators are content to earn a comfortable living doing little physical work, but enjoying their work thoroughly! We don't say you'll be a mail order millionaire or another Sears & Roebuck, but if you're looking for a business of your own with financial security, the answer is mail order. If you've already tried mail order with little or no success, don't give up! Try to analyze what went wrong. Success comes only to those who keep trying and learn from their own mistakes. Again we emphasize, deal only with a reputable firm.

The A. J. Statile Co. has been in business for over twelve years. They gladly furnish bank or trade references upon request. They are probably one of the largest mail order wholesalers in the country. Whether it be toys, gifts, vitamins or appliances—they've got it ready to ship under your label WITHIN 24 HOURS!

Firmly convinced that no other business offers the tremendous opportunities of mail order, A. J. Statile, president of the firm, is an outspoken advocate of the man or woman who wants to start in business for himself. As Statile puts it, "by all means, start your own business and start NOW! If you want a chance at security and financial independence make your choice mail order. There's nothing like it. Absolutely nothing!"

FOR FREE DETAILS

Mail coupon below — no obligation

A. J. Statile Co., Dept. 14 • 115 Patterson Street, Hillsdale 14, New Jersey

Dear Mr. Statile:
Please send me complete FREE details telling me how I may obtain a franchised mail order dealership with your firm. I understand I am under no obligation and no salesman will call on me.

NAME..... AGE..... SEX.....

ADDRESS .....

CITY..... ZONE..... STATE.....

PREVIOUS EXPERIENCE, IF ANY.....

1

Sander base is adaptable for mounting on various power machines or on own stand for direct V-pulley motor operation. Slight adjustment of turnbuckles on side rails controls belt tension, helps keep belt centered on pulleys.

Build Your Own

BELT SANDER

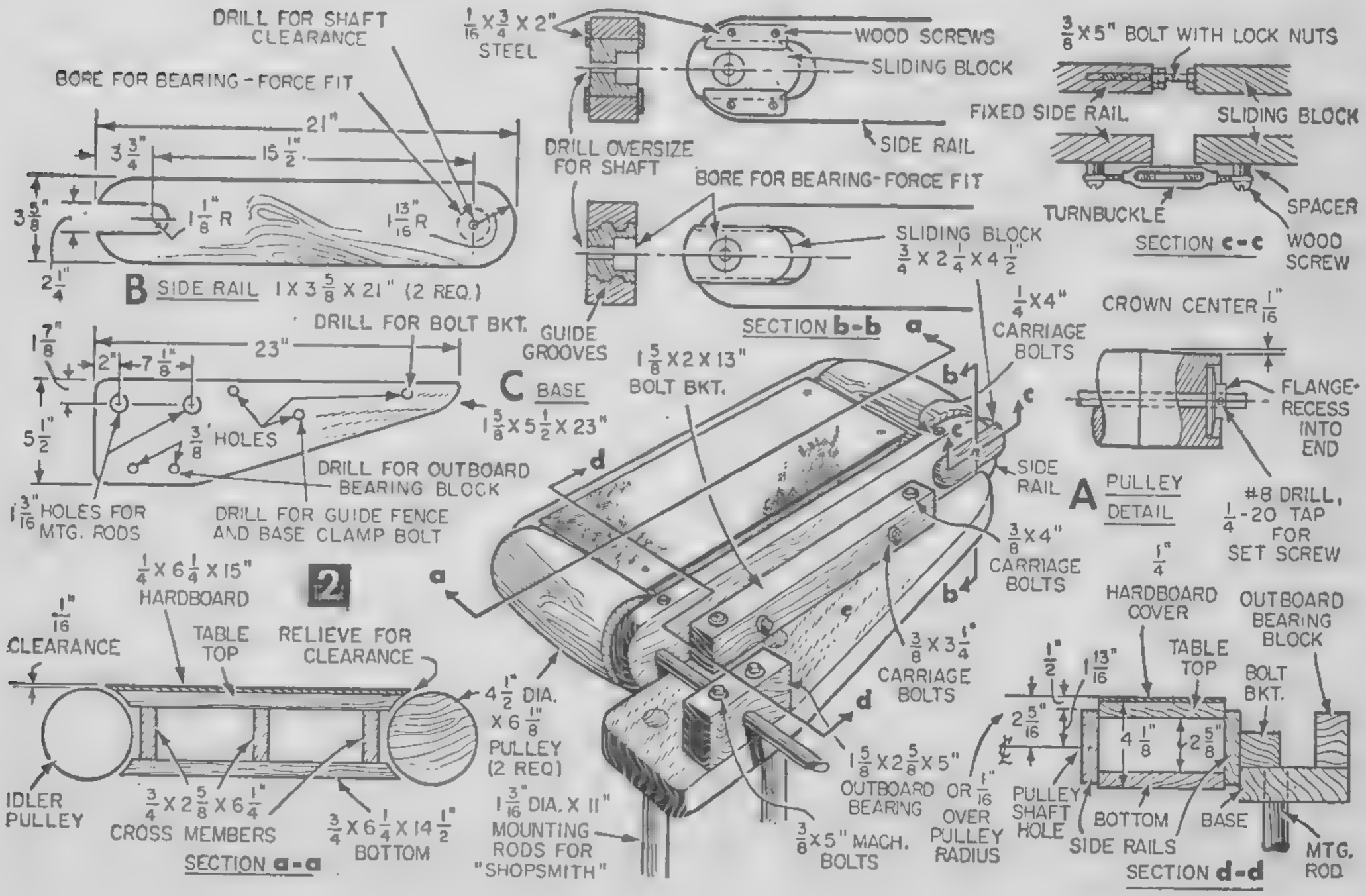
This wood-surfacing "smoothie" has two guide fences for end or side finishing at any angle

By RALPH G. HENDRICKSON

SANDING of a professional caliber comes easy with a 6-in. belt sander you can make out of a few pieces of stock lumber from your local yard.

If your home workshop is like ours, chances are you can duplicate most of the unit we built (Fig. 1) at a saving of up to $50 — by using the scrap material in your "junk bin." We needed only the cost of a 6 x 48-in. sanding belt and a few common hardware items.

While the unit in Fig. 1 was fitted to a *Shopsmith*, it can be adapted to other power equip-



ment by modifying the base. You can also drive it with a ¼ or ½-*hp* motor by mounting it on a suitable stand and using V pulleys.

Most dimensions in the drawings may be freely altered to suit what lumber stock you have on hand. For that reason, several location dimensions for the various wood parts and bolts are omitted.

Make the Pulleys First, since belt size and pulley diameter determine the table length (section a-a in Fig. 2). Long-wearing maple or other hardwood is preferable, but pine can be used. If you do not have 4½ x 4½-in. or larger stock, glue up a block from two or three pieces of the hardwood; then cut off two 6¼-in. lengths.

Before turning the wood, acquire shafts for the drive and idler pulleys, with bearings to fit. Diameters need not be exactly as specified in the Materials List—we chose them because they were on hand. Center drill through the length of each block for a tight fit with its shaft.

To reduce clearance between pulleys and side rails, recesses are bored into pulley ends to take mounting flanges as in Fig. 2A. You can obtain the flanges in many hardware stores or get pipe floor flanges from a plumbing shop. Buy the sizes that will just slip on your shafts, or you can ream them to fit. Drill and tap flange hubs for setscrews as in Fig. 2A.

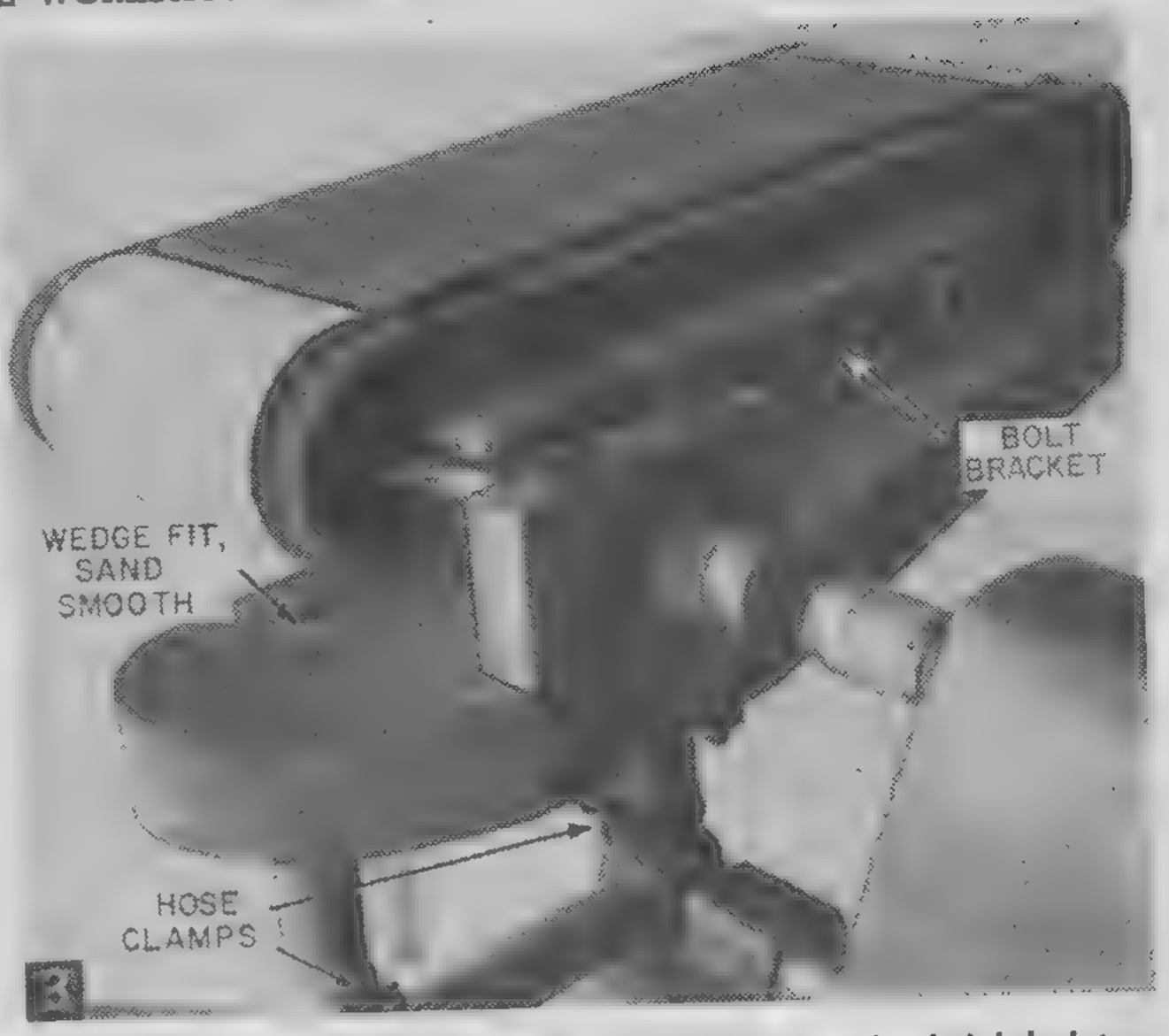
Push a shaft through a block slide on a flange, attach it to an end of the block with screws and tighten setscrew on shaft. Mount in your lathe, using shaft to drive the block. Square off opposite end and bore recess for the flange. Remove from lathe, install flange in the recess with screws and lock onto shaft with setscrew. Mount this end of shaft in the lathe and remove other flange. Square off other end until block is 6⅛ in. wide, then bore recess and replace flange.

Now you are ready to turn the pulley to approximate 4½-in. dia., leaving a 1/16-in. crown in the middle to insure accurate tracking of the sanding belt. Make the other pulley the same way.

Side Rail Belt Adjustment. Next cut and shape the sanding table sides as in Fig. 2B and slightly bevel edges. For control of belt tension and tracking, cut sliding blocks with care to insure a smooth, sliding fit in the side rail recess as in b-b of Fig. 2. Drill hole for idler pulley shaft slightly oversize and bore on inside edge so bearing fits with force fit. Install bearings.

To retain sliding blocks in their recesses, cut grooves on a shaper with a 3-wing cutter, using either the glue-joint groove as in b-b of Fig. 2 or a matched tongue and groove cutter set. If you do not have a shaper, you can hold the blocks in place with small 1/16-in. steel guide plates attached to each side of the side rails as in b-b of Fig. 2.

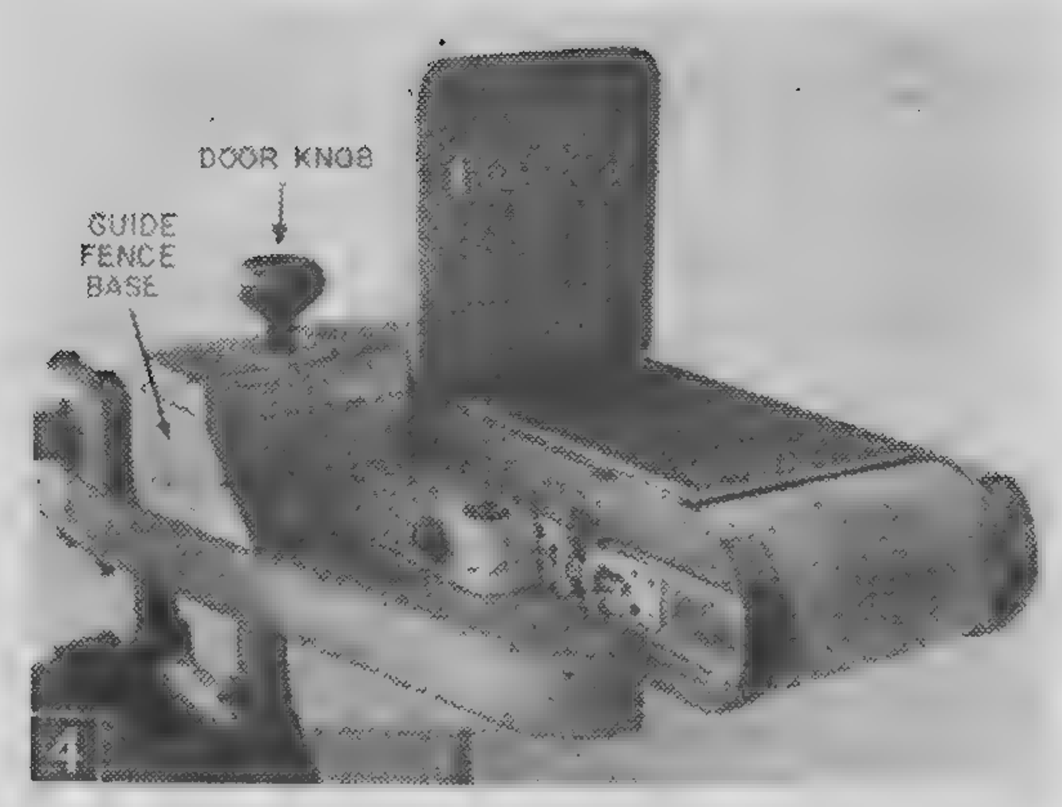
For tension on the belt, hook up the sliding blocks to side rails with small turnbuckles as

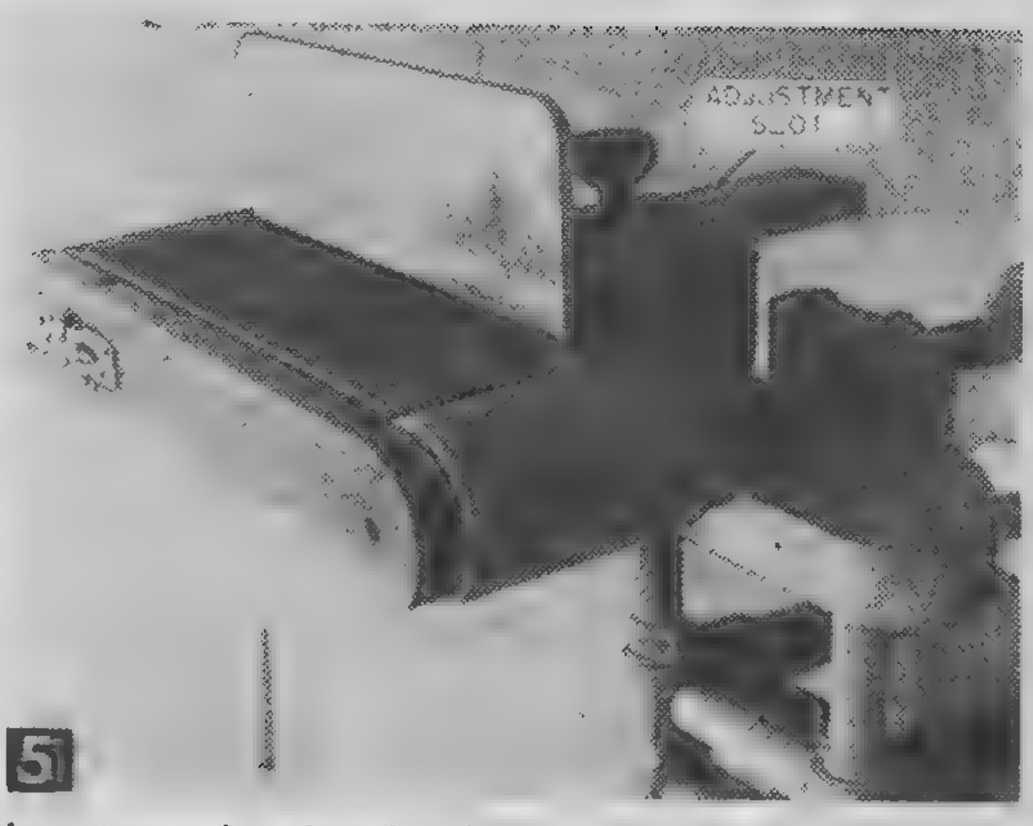


Hardwood rods to fit frame of power unit are wedged tightly into base and ends sanded smooth. Once sander is aligned with machine, mark position by attaching hose clamps tightly to rods against frame. This will insure easy return of sander, after removal, to proper working height.

MATERIALS LIST—BELT SANDER

No. Req.	Size and Description
1 pc	1⅝ x 5⅝ x 32" pine (base, glued-up fence base block)
1 pc	¾ x 7½ x 30" pine (table top and bottom, guide strips)
1 pc	¾ x 3⅝ x 43" pine (side rails)
1 pc	¾ x 2⅝ x 72" pine (cross members, sliding blocks, panel baseboard, fence support)
1 pc	1⅝ x 2⅝ x 20" pine (bolt bracket, outboard bearing block)
1 pc	1⅝ x 5⅝ x 40" hardwood (glued-up pulleys, mounting rods) (if not available, substitute white pine)
1 pc	¼ x 6¼ x 15" hardboard table cover)
1 pc	⅜ x 12 x 15" plywood (fences)
1	⅝" dia x 15" steel rod (driving shaft)
1	7/16" dia x 8" steel rod (idler shaft)
4	2½" dia steel flanges (for pulleys—2 bored ⅝", 2 bored 7/16")
3	⅝" I.D. ball bearings (for drive shaft) (try local garage, machine shop)
2	7/16" I.D. ball bearings (for idler shaft)
2	3½" common turnbuckles (for sliding blocks)
2	1 3/16" hose clamps (for mounting rods)
2 pcs	1/16 x ½ x 8" strap iron (clamp strips on mounting rods)
Misc.	2 pr 2" butt hinges, 1 pr 1" butt hinges, 2' #8 wire, 2 ½"–dia x 2" binding posts, 1 ⅜ x 6" machine bolt, 2 ⅜ x 5" machine bolts with nuts, 2 ⅜ x 4" carriage bolts with nuts, 2 ⅜ x 3¼" carriage bolts with nuts, 4 ¼ x 4" carriage bolts with nuts, 12 ⅜" I.D. washers, 8 ¼" I.D. washers, small piece ¼" steel plate, 2 doz #10 x 1½" *fh* wood screws, 4 #8 x ⅞" *fh* wood screws, 6 #5 x ½" *fh* wood screws, glue





Left, across-belt fence speeds sanding against grain, helps to smooth or bevel end edges. Fence tilts backward only, to prevent work being wedged between belt and fence. Right, parallel guide has adjustment slot, clamps at any point best suited to sand with the grain or handle side edge work. Fence can tilt up to 45° in either direction. Belt is removed to show construction detail. Note "streamlined" back of fence base.

in Fig. 1 and in section c-c of Fig. 2. You may need spacers under each turnbuckle eye for clearance. As an alternate, try a long bolt with locknuts as in section c-c of Fig. 2. Bolthead bears against end of the sliding block and locknuts maintain the tension.

You can eliminate the likelihood of a side rail splitting by installing ¼-in. dia. x 4-in. carriage bolts through its width near each end.

Assembling the Table. To determine length, fit pulleys inside sanding belt, extend belt to full length and measure the clear distance between pulleys. Allow about ½-in. clearance for variations in belt length. Width should equal overall pulley length from flange ends, plus thickness of any washers used between flange hubs and bearings. Make the table depth at least ⅜ in. less than pulley diameter.

Cut the table pieces, then assemble top and bottom to the three cross members as in a-a of Fig. 2, using glue and #10 x 1½-in. *fh* (flathead) screws. Bevel or round off ends to clear pulleys.

Clamp side rails to table so that the tops are about 5/16 in. below table top and so that table end will just clear the drive pulley. If bearing holes were bored accurately, the drive shaft will parallel the table top and be at right angles to table centerline. If not, loosen clamps and reposition side rails to line up shaft. Reclamp and mark all pieces for reassembly later.

Now cut out and shape the base, outboard bearing block and bolt bracket as in Fig. 2 and 2C, but do not drill any holes yet. Fit the clamped assembly to the base as in d-d of Fig. 2 and position the bearing block so that table top is slightly higher than the block.

Position bolt bracket on base next to the assembly as in Figs. 2 and 3. Mark location of bolts through bracket, base and side rail on all parts. Remove side rails from assembly, drill all holes marked and fasten bracket to base with carriage bolts. Next, insert carriage bolts from inside edge of rail, making sure the heads fit tightly since they will not be accessible during assembly.

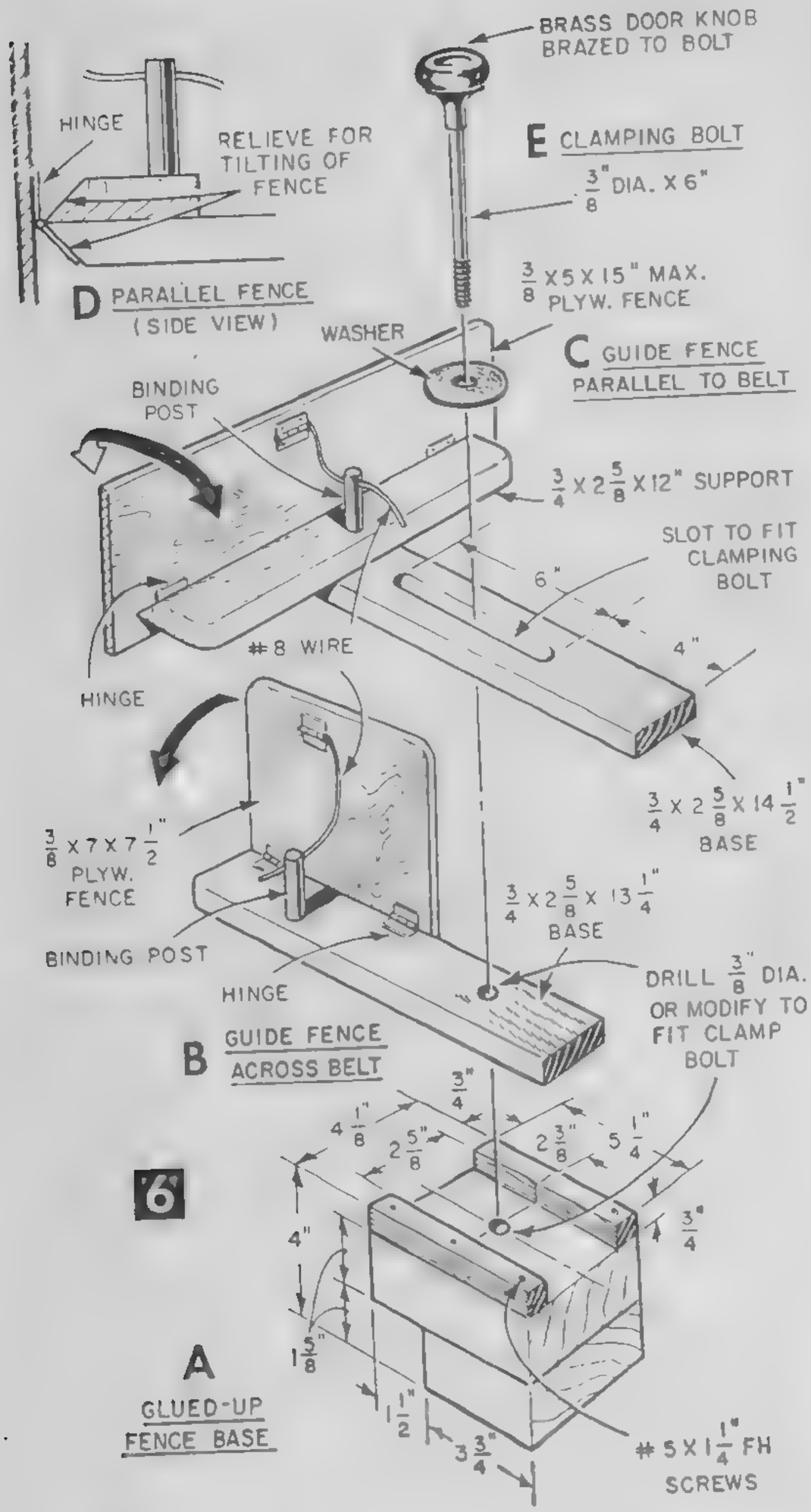
Align side rails with your marks on table, then attach with glue and #10 x 1½-in. *fh* screws. Assemble the drive shaft and pulley into the table, then insert the side rail carriage bolts in the bolt bracket and clamp tightly to the base. Drill shaft hole and install bearing in outboard bearing block, position it to align with shaft, drill base holes and clamp in place with 5-in. machine bolts.

Complete the sander construction by assembling the idler pulley, shaft and sliding blocks and fitting the unit into the side rail recesses. Tighten pulley setscrews on both shafts. Cover the table top with ¼-in. hardboard of the same width and about ¼ in. longer on each end. For firm, flat sanding surface, board should be about 1/16 in. higher than pulleys. Attach the board with four #8 x ⅞-in. *fh* screws, one near each corner, and countersink each head well.

Mounting Tips. If you own a Mark 2 or Mark 5 Shopsmith—or a Model 10ER equipped with power mount adapter—you can mount and drive the sander in the same way as other accessories for these units.

Turn two hardwood rods approximately 11 in. long to 1 3/16-in. dia. to fit mounting holes in end of frame. You can relieve the pressure of clamping screws against these rods by rabbeting a groove ½ in. wide and 1/16 in. deep in the side of each rod parallel to the centerline. Insert strap iron strips in the grooves and secure with countersunk *fh* screws.

Locate base holes for these rods at right angles to centerline of the sander drive shaft, while this shaft is in line with the Shopsmith driving shaft. Drill the holes to take rods in a tight fit, then glue and wedge the rods into



position with the strap iron inserts facing each other.

To load your sander, close up turnbuckles enough to slip belt around pulleys and table, then expand the buckles until belt is tight. Connect drive shaft to the power unit, switch on the motor and adjust turnbuckles as necessary to keep belt running smoothly in its path around the pulleys. Try sanding a piece of scrap briefly to check the movement, make any additional minor adjustments and your newest shop tool is ready for use.

Fence Attachments. The basic unit is adequate for handling flat wood surfaces but you can do a neater job smoothing sides and edges by making the two simple guide fence attachments in Figs. 4 and 5. Since each fence is hinged, they can be clamped to hold work at almost any angle for beveling and some shaping operations.

You can build a common base for these guides by gluing and nailing together two pieces of 1⅝ x 5⅝-in. scrap (nominal 2 x 6) as in Fig. 6A. The bottom piece is cut back just enough to fit around the bolt bracket and allow top pieces to butt against table side rail. In this position, drill through block and sander base for long bolt to hold fence in place. Install strips along top edges to guide the fence baseboards.

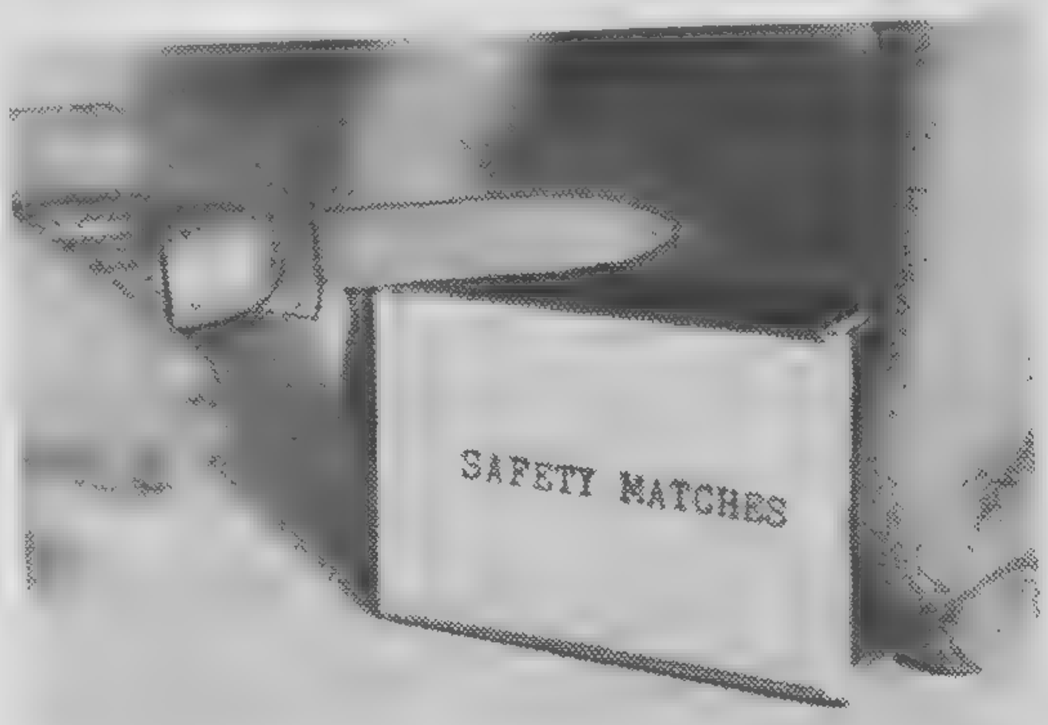
Make the across-belt and parallel-to-belt guide fences as in Fig. 6B, C and D, using plywood pieces for the fences and some ¾ x 2⅝-in. pieces (nominal 1 x 3) for other parts. To control the fence angle, install both sides of a 1-in. butt hinge near the top of the fence and knock the pin out. Thread fairly stiff wire such as #8 through the hinge and bend over the slightly protruding end to keep it from pulling out. Bend back other end of wire and run it through a clamp post on the fence support, then slightly curve wire until it will permit free movement through the post as the fence is moved into any position within its range.

Eliminating Loose Tools. If you have an old brass knob handy, braze it to the head of the 6-in. machine bolt used to clamp fence assembly to sander base. It makes a convenient handle as in Fig. 4, and does away with the need for a wrench. For another time-saver, drill and tap a small piece of ¼-in. steel and attach it in position under bolt hole on bottom of the base. Thus, there is no loose nut to fumble with every time you shift, change or remove fence guides.

Where you use a loose tool such as a small wrench for the turnbuckles, shape a small holder for it out of wire or metal sheet and attach it to the edge of the base near the idler pulley. The tool will be out of the way but always handy when wanted.

Match Striker Keeps Blade Sharp

• When you want to keep a knife or chisel sharp while doing delicate carving, just keep a safety match box nearby and use the striker



to touch up the cutting edge often. The fine abrasive will keep the blade keen without disturbing the general shape of the edge.—JOHN A. COMSTOCK.

Shop Cabinet-Desk

Here are 30 copies of SCIENCE and MECHANICS issues waiting for your quick selection. Indexing notebook on the right tells where to find that project you want to work on! Clips hold magazines open to page desired.

DESIGNED to hold a 30-copy series of SCIENCE and MECHANICS magazines plus several how-to-do-it handbooks, this dustproof cabinet, shown in Figs. 1 and 3, also has a compartment for Craft Prints or a notebook for indexing magazine subjects you want to refer to.

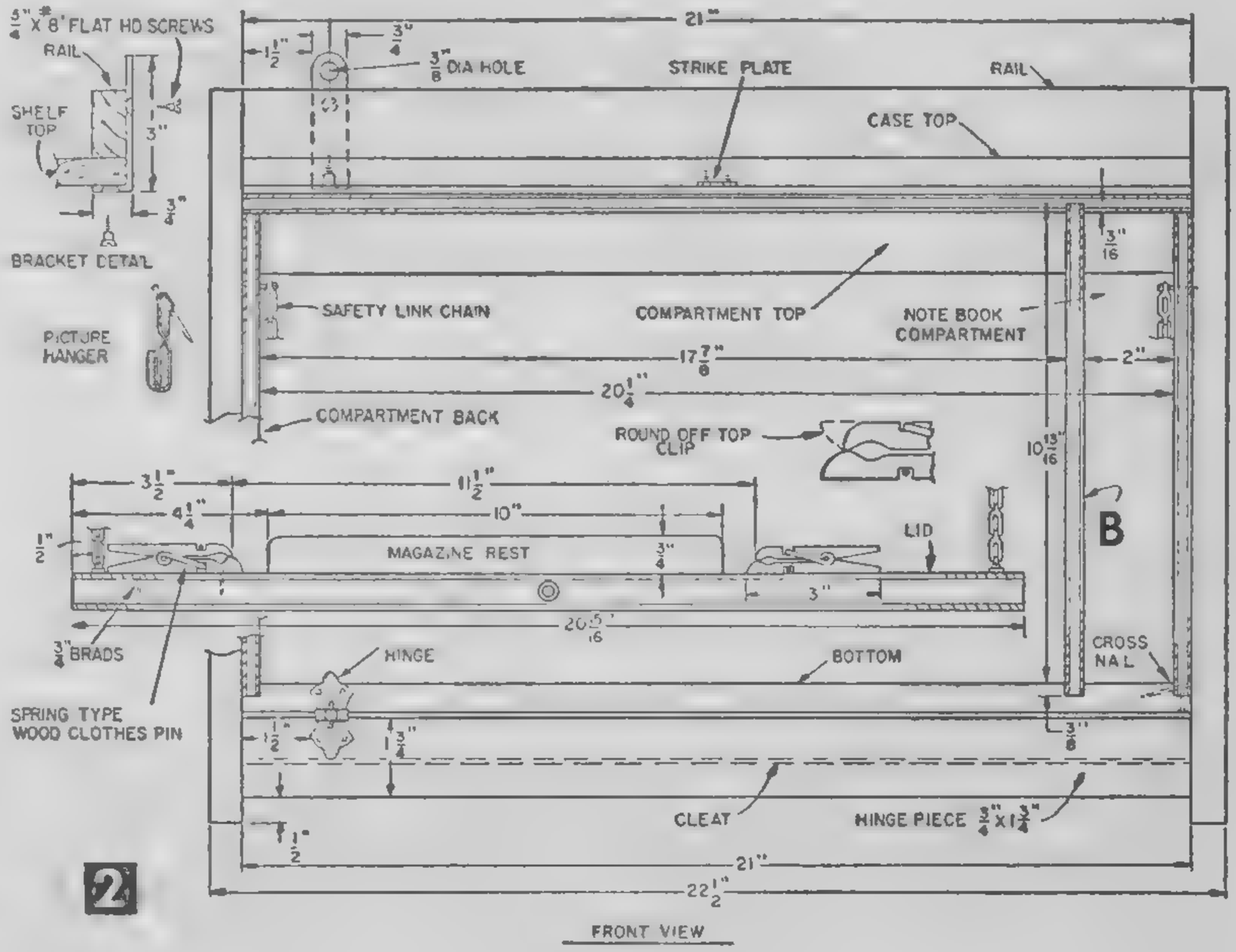
By listing article titles, date of issues, and page number under convenient headings, you have a veritable do-it-yourself encyclopedia for instant reference. The cabinet can be hung on your shop wall or placed on your desk.

While our file cabinet was made of pine and plywood and then painted, a cabinet wood finished with clear lacquer could be used for the outer parts and lid to harmonize with your desk. Either way, presand parts with 2/0 paper before assembly to ease the final sanding.

Cabinet Compartment. Start by setting the compartment bottom to size as given in the Materials List. Then with a shaper or molding head cutter in your circular saw, cut a cove (to hold pencils) along front edge of the bottom as in Fig. 2A. Bevel the front edge 10°. After sawing the ⅜-in. plywood compartment ends, top, back and partition to size, setup the dado head cutter in your circular saw to take a ⅜-in-width cut and saw ⅜ x ⅜-in. rabbets at the ends of the bottom piece. Also, cut a ⅜-in. deep dado in the bottom and a 3/16-in. deep dado in the top for the partition (Fig. 2B). With 1-in. lathe nails and glue, join the compartment back to the bottom, then assemble the ends and top. Immediately remove excess glue with a moist cloth.

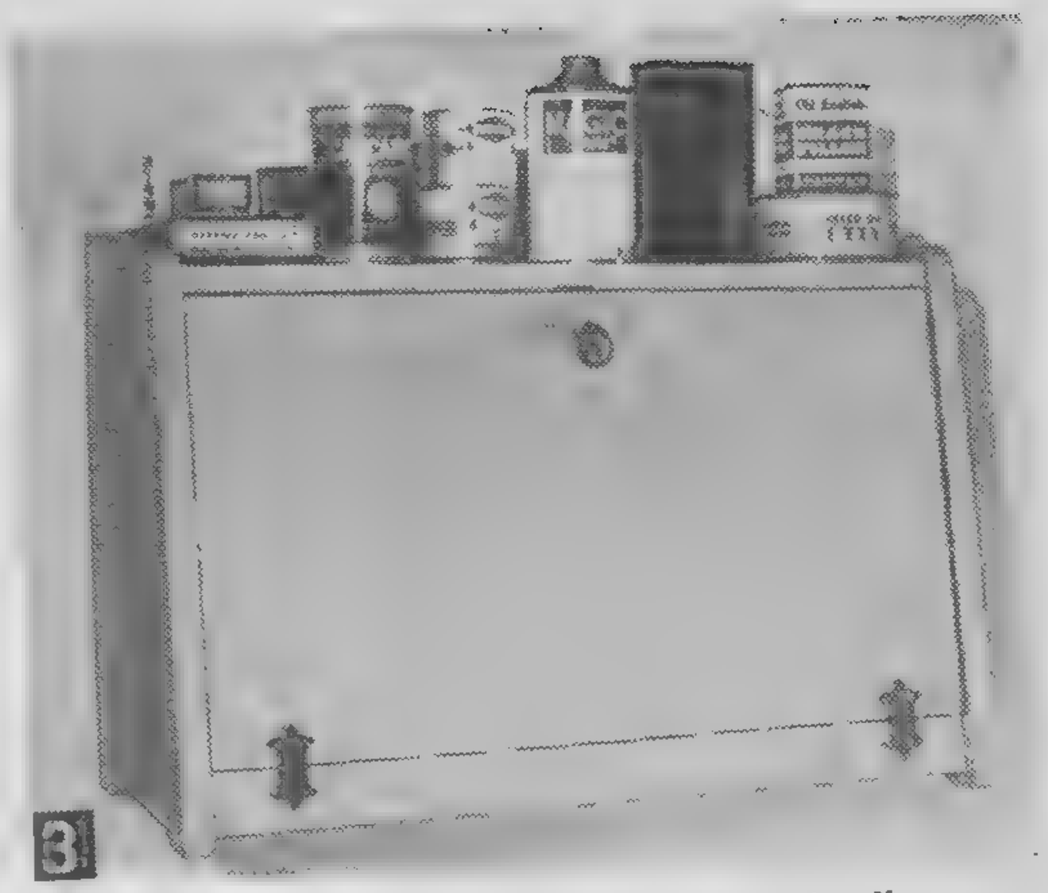
Cabinet Case. Make a full-size drawing of the case side on cardboard as detailed in Fig. 2C. Cut this out to form a template so that you can transfer the shape of the side to the wood and mark the location of the compartment on the sides.

Cut side pieces simultaneously on a band



saw, after nailing stock together in what will be scrap-wood cutoffs. Place template on inner surface of the sides to mark compartment locations. Attach the compartment with glue and 1-in. lathe nails, then insert the partition, fastening to top and bottom with 1-in. lathe nails. Cut the remaining case parts to dimensions given in front and side views of Fig. 2. Bevel the front edge of the top 10° (Fig. 2D). Glue ends of the cleat, hinge piece, top and rail and join to sides, using 7d finishing nails. Fit the lid next, then glue and brad the magazine rest to it as in Fig. 2B.

Now, sand all surfaces with 3/0 paper and smooth with 6/0 paper. Dust off, apply a primer coat of flat white, and sand with 6/0 paper. Next, set the nail heads, fill holes with spackling putty and smooth with 6/0 paper.



Cabinet top is convenient place to keep miscellaneous materials for the job at hand.

Dust thoroughly and apply two coats of enamel.

Install the door catch, knob and lid hinges. Mortise in the door catch strike. Bend the lower link of each lid-supporting chain outwards, as in Fig. 2E, and attach to the lid with round head screws. Locate upper-link screws so the lid will slant about 4° below horizontal.

Take apart two wooden clothes pins, which will hold open a copy of S&M on the lid, and brad the lower clips in place. Round the upper clips as in Fig. 2 so they won't obscure the type adjacent to the margins, then reassemble the clothes pins.

Place the case on a bench top, desk, shelf or, using brackets and picture hooks (Fig. 2), suspend on a wall so the opened lid will be at waist level (Fig. 1).—FRANK HEGEMEYER.

MATERIALS LIST—SHOP CABINET-DESK

Compartment

No. Req.	Size and Description
1 pc	3/4 x 7 5/8 x 21" pine (bottom)
1 pc	3/8 x 8 x 21" fir plywood (top)
2 pcs	3/8 x 8 x 10 5/8" fir plywood (ends)
1 pc	3/8 x 11 x 20 1/4" fir plywood (back)
1 pc	3/8 x 7 5/8 x 10 13/16" fir plywood (partition)

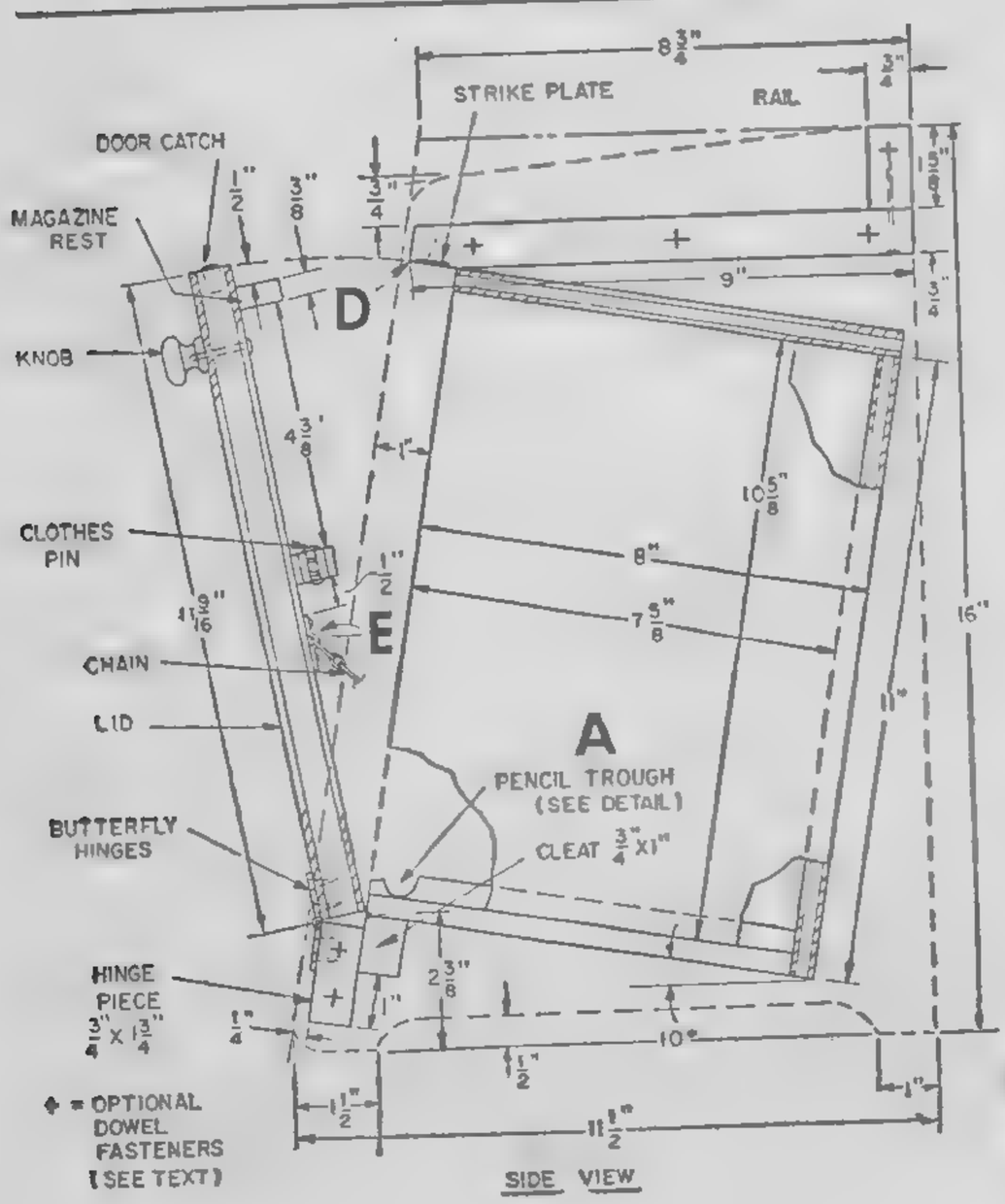
Case

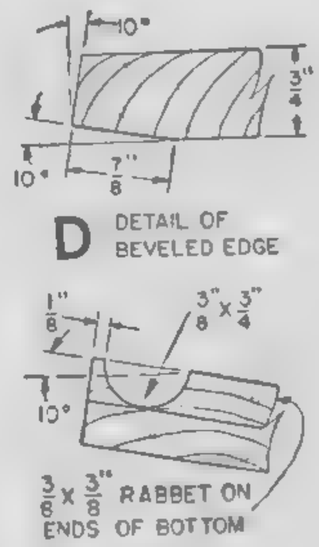
2 pcs	3/4 x 11 1/2 x 16" pine (sides)
1 pc	3/4 x 9 x 21" pine (top)
2 pcs	3/4 x 1 3/4 x 21" pine (rail, hinge piece)
1 pc	3/4 x 1 x 21" pine (cleat)
1 pc	3/4 x 11 9/16 x 20 15/16" fir plywood (lid)
1 pc	3/8 x 3/4 x 10" pine (magazine rest)

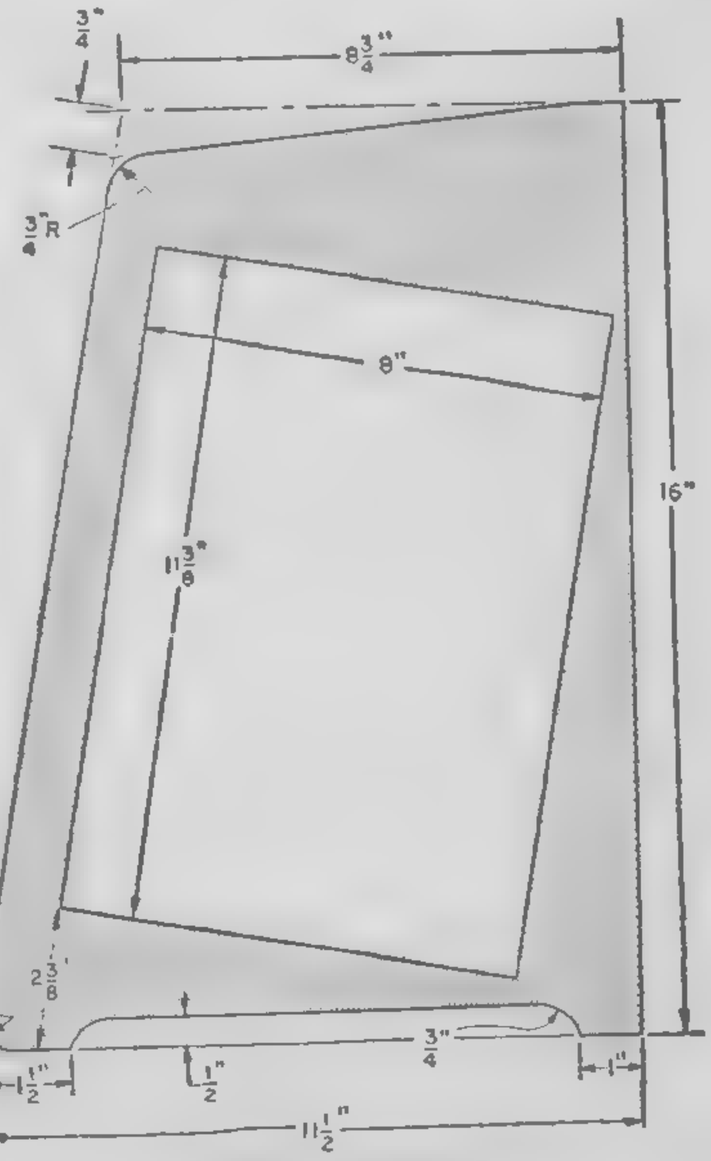
Miscellaneous

1 pr	3/4 x 2 1/2" butterfly hinges
2	3" long spring-type wood clothes pins
1	3/8" dia. bullet-type door catch
2	12" lengths No. 0 link safety chain
2	1/16 x 3/4 x 3 3/4" metal hanger brackets (opt.)
2	picture hangers, 40 or 50-lb. test (opt.)
4	#8 x 3/4" *fh* (flathead) screws
2	#7 x 1" *rh* screws
4	#6 x 5/8" *rh* screws

1" dia. wood or metal knobs, 1" lathe nails, 7d finishing nails, brads, liquid glue, 1 1/2 x 7 x 9" loose-leaf note book, 5 1/2 x 8 1/2" indexing inserts.







2

The playhouse has a covered patio with the door up (right) and becomes a backyard slide and climbing unit when the door rests on the bench. Bikes and wagons are stored inside to make more room in the garage.

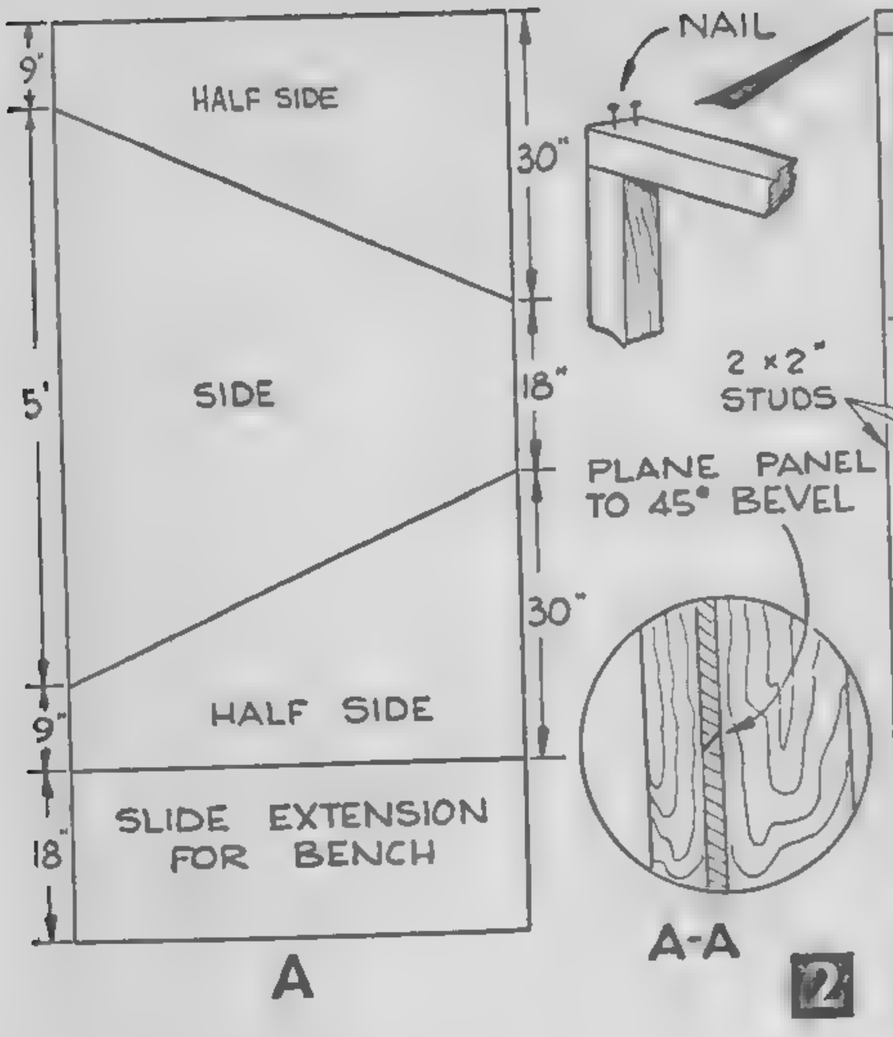
Store Toys and Tools in a Portable Playhouse

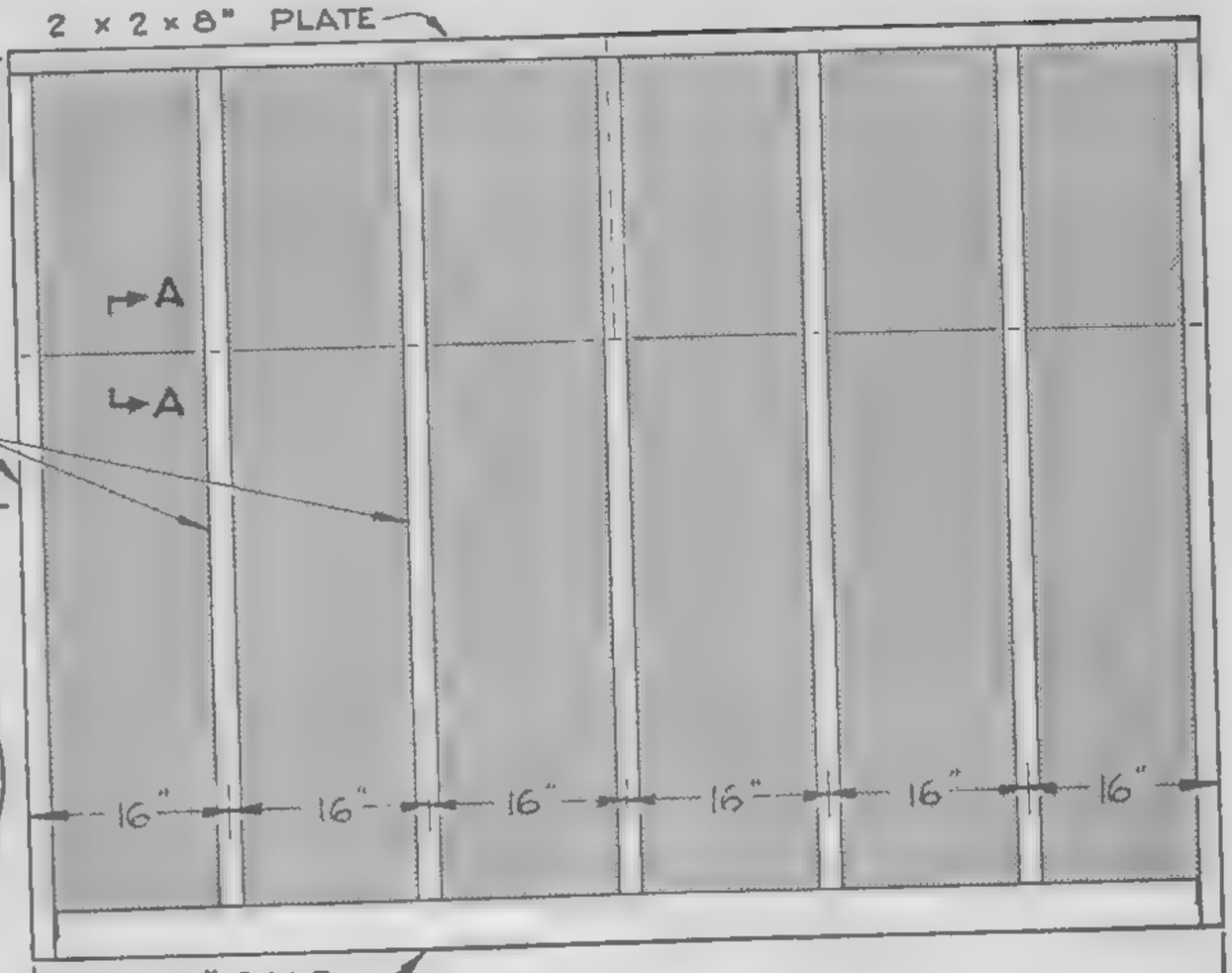
This free-standing storage unit can be used year 'round, or taken apart and easily transported

By DONALD R. MATHESIUS

EASE the squeeze in your garage with a backyard storage unit that not only provides you with a place to keep garden equipment and such storage problem toys as bikes and wagons, but can also be used by your children as a playhouse where they can enjoy a covered patio, backyard slide, and a climbing unit.

The combination storage-playhouse unit is designed so you can construct it with either





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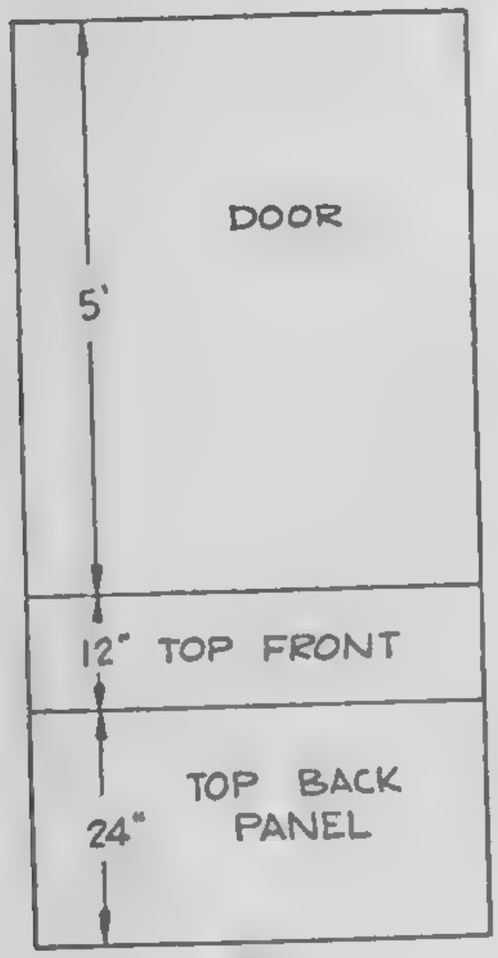

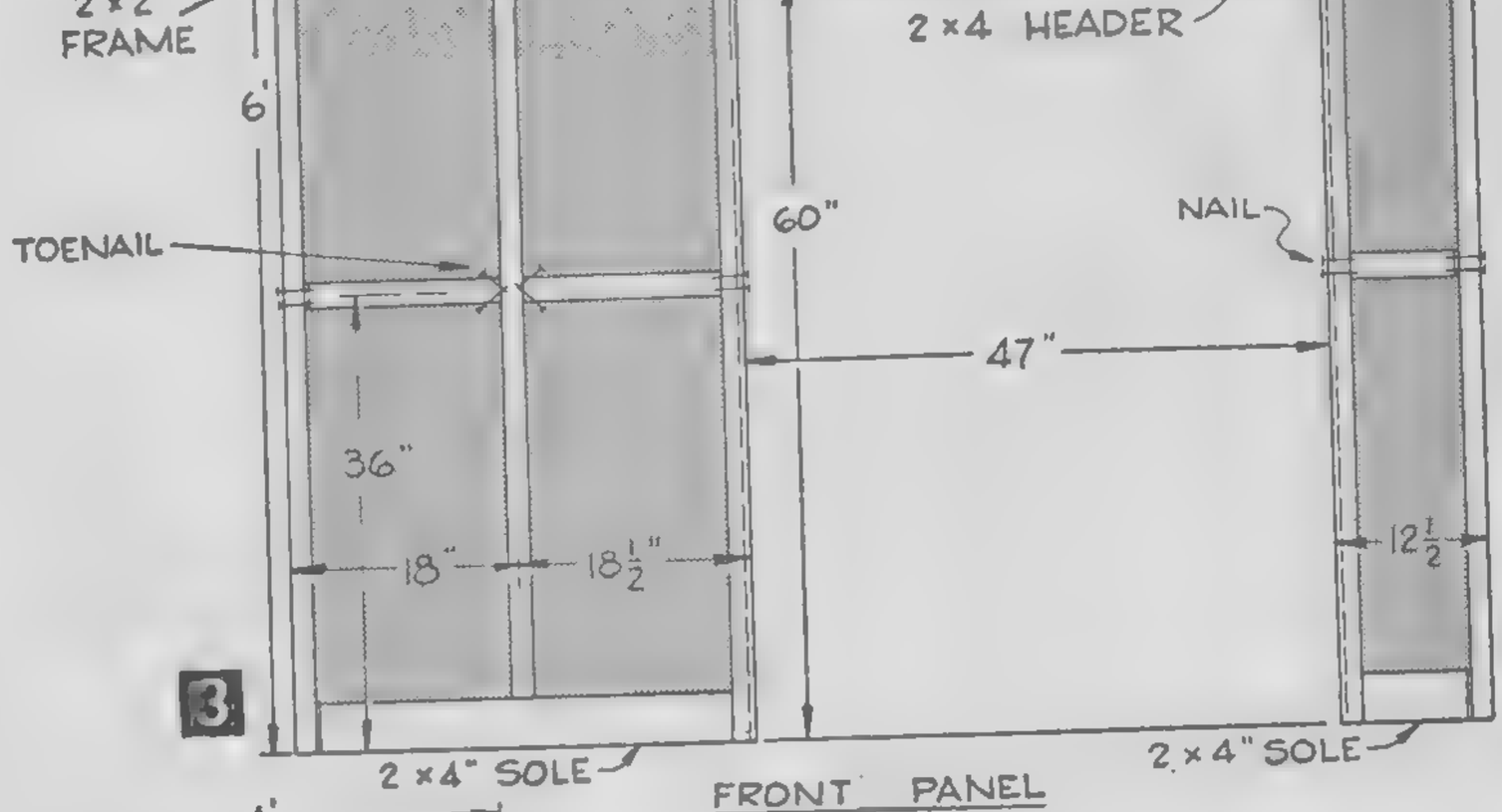

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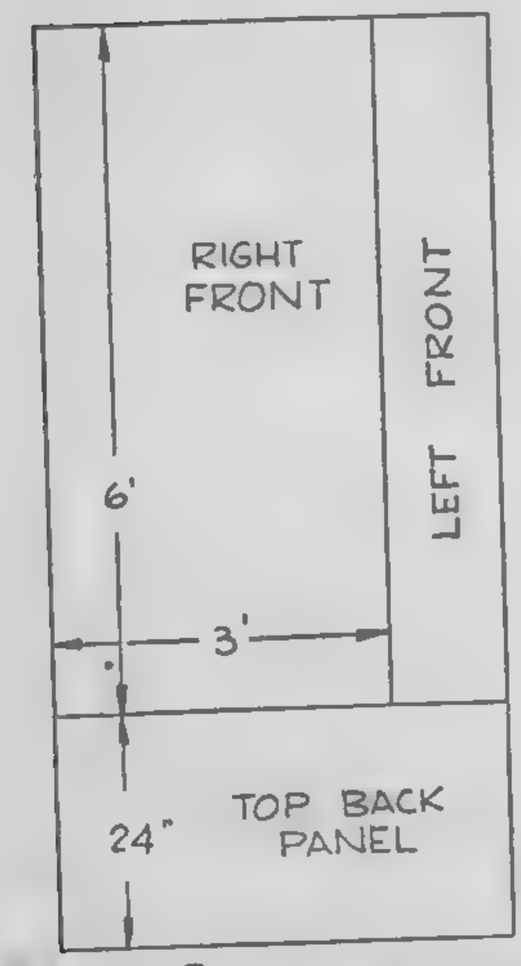
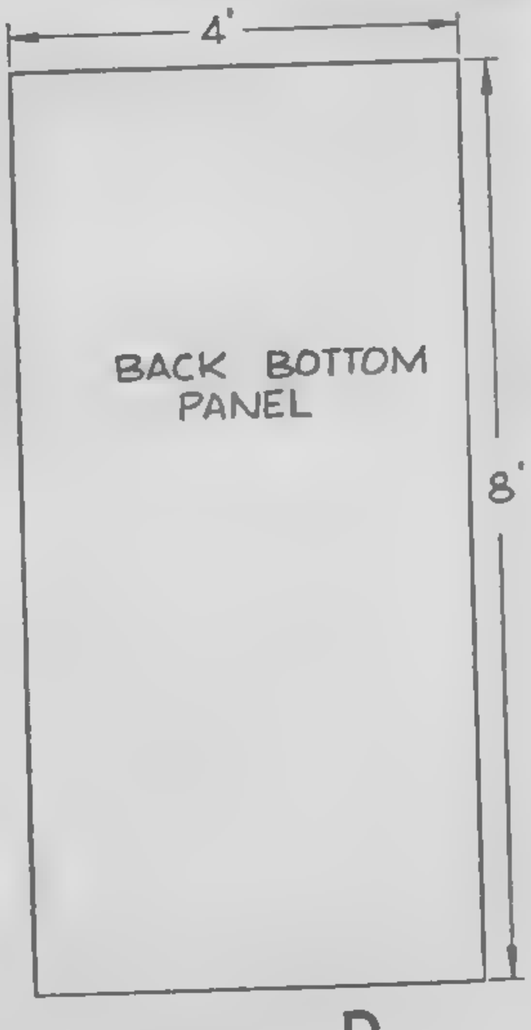
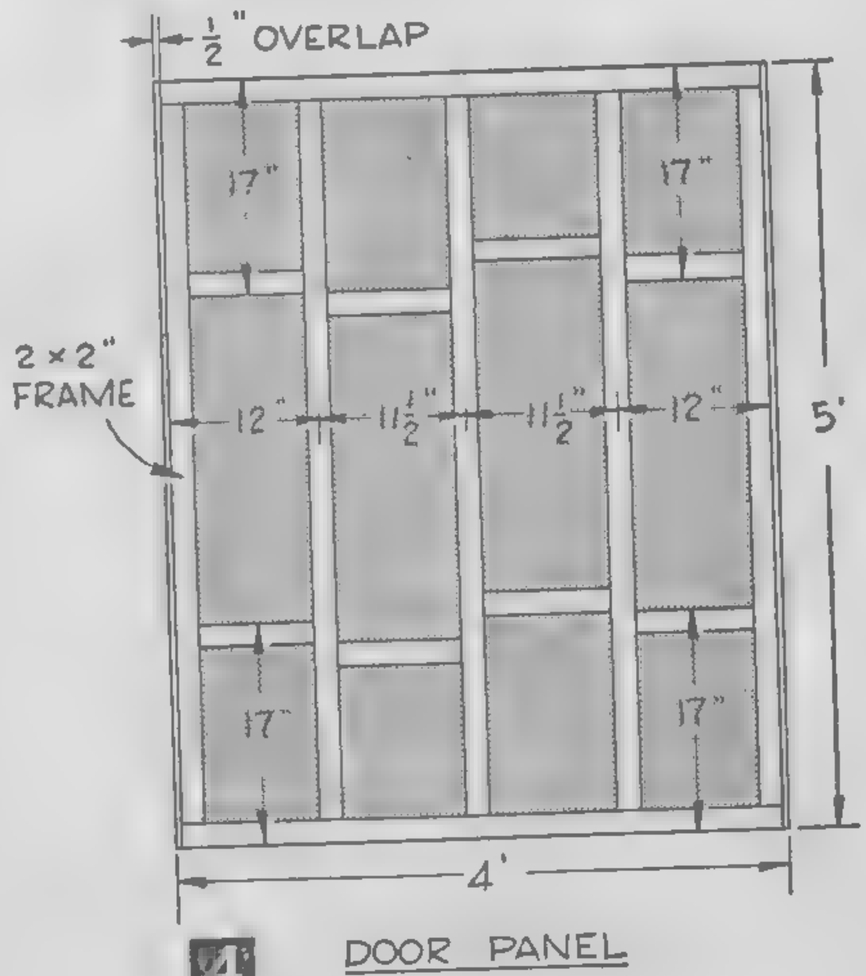
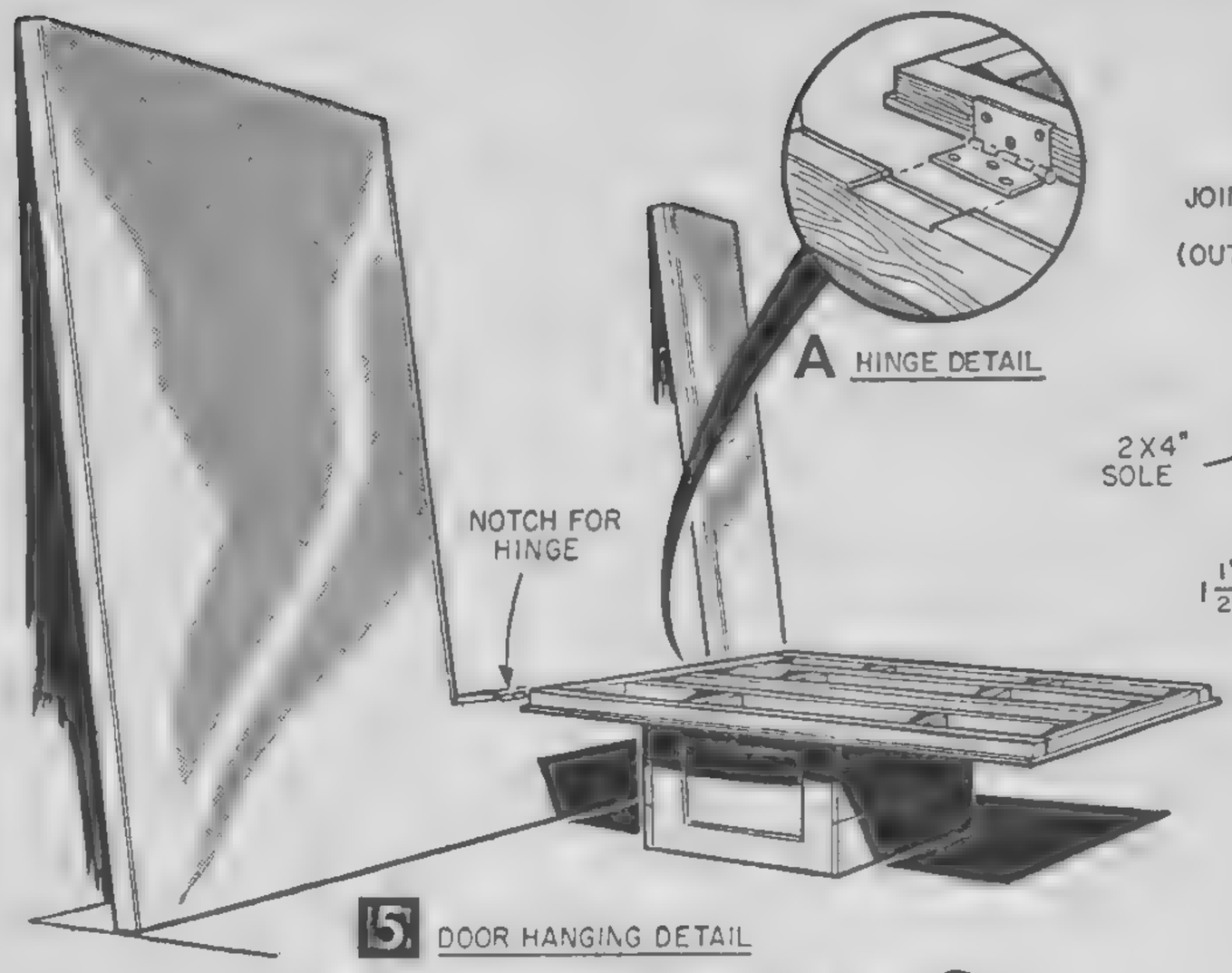




1 4 × 8' PANELS — 4 REQ.

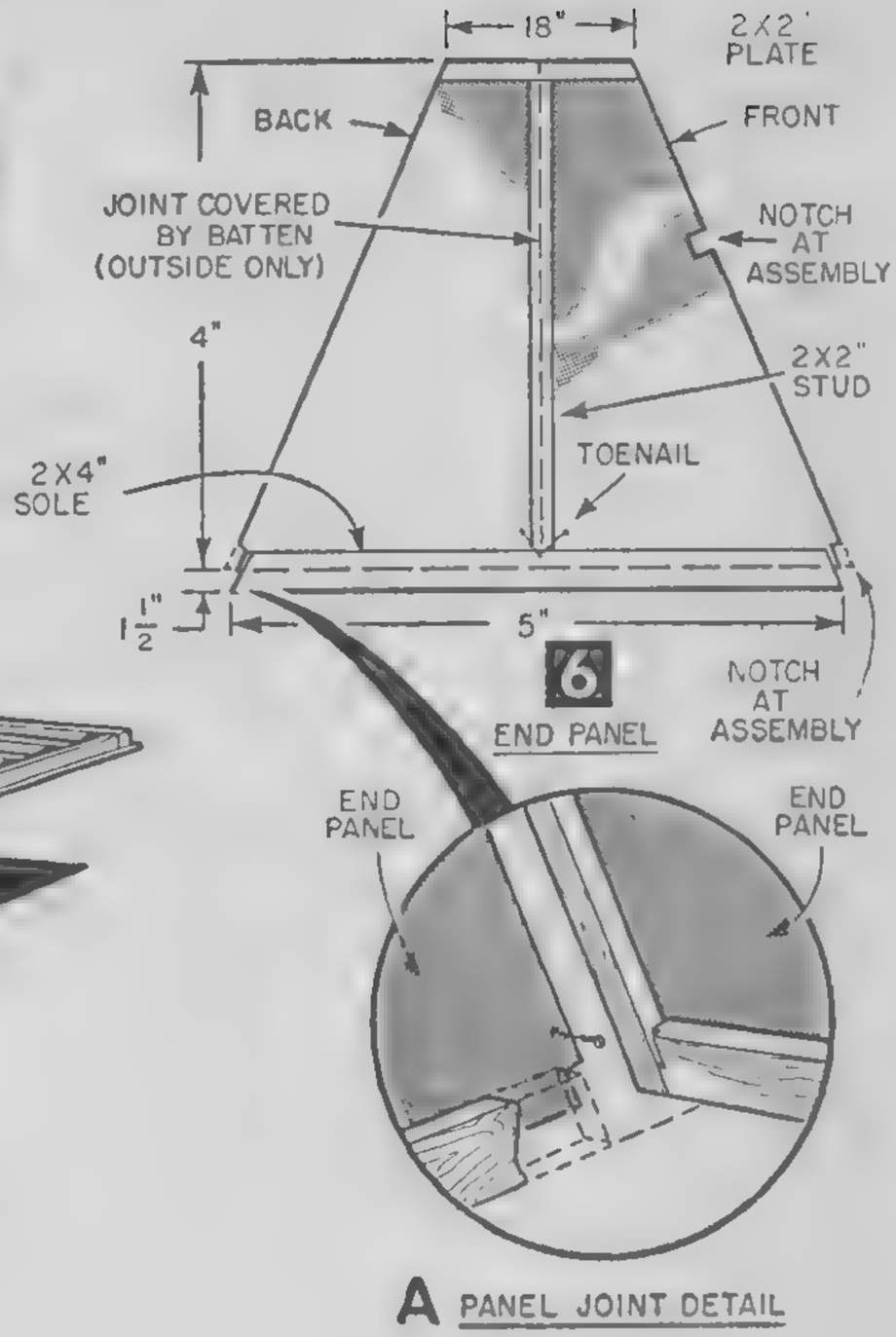


4 DOOR PANEL



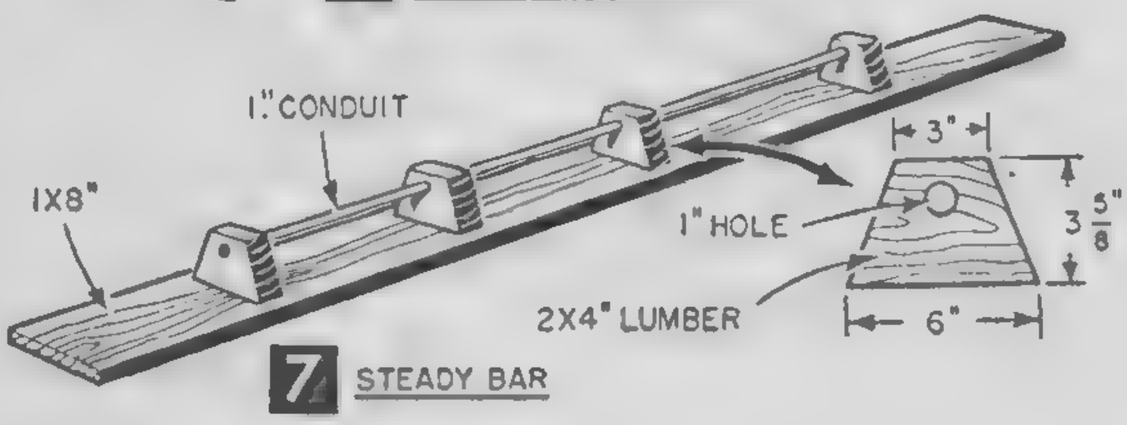
5 DOOR HANGING DETAIL

A HINGE DETAIL



6 END PANEL

A PANEL JOINT DETAIL



7 STEADY BAR

hand or power tools, and it will cost about one-third the amount needed for many commercially built storage units.

All the material you need for the job is available from your lumber dealer (see Materials List).

Set to work (Fig. 1) by pre-cutting your panels for the back, front, and end sections. It is best to lay out and cut each panel separately so you can allow for cutting waste and be sure that each panel is the size required for a given section.

The sheets for the back panel (Fig. 2A) have to be beveled to a 45 degree angle where the upper and lower sections meet to insure an air tight fit.

Use 16*d* nails to assemble the framework and, unless otherwise indicated, 1½-in. galvanized roofing nails to attach the panels to the framework.

To Construct the Framework for the back panel (Fig. 2), lay the material on the ground the way it will be assembled in the frame. The top plate is a 2 x 2, 8 ft. long, vertical studs are 2 x 2s, 6 ft. long, and a 2 x 4, 8 ft. long, is the bottom sole.

Nail the end studs to the top plate (Fig. 2B). Measure the distance between these studs and cut the sole to the same length. Nail it in place between the two end studs. The other studs are cut to exact length, put on 16-in. centers between the plate and sole, and nailed in place.

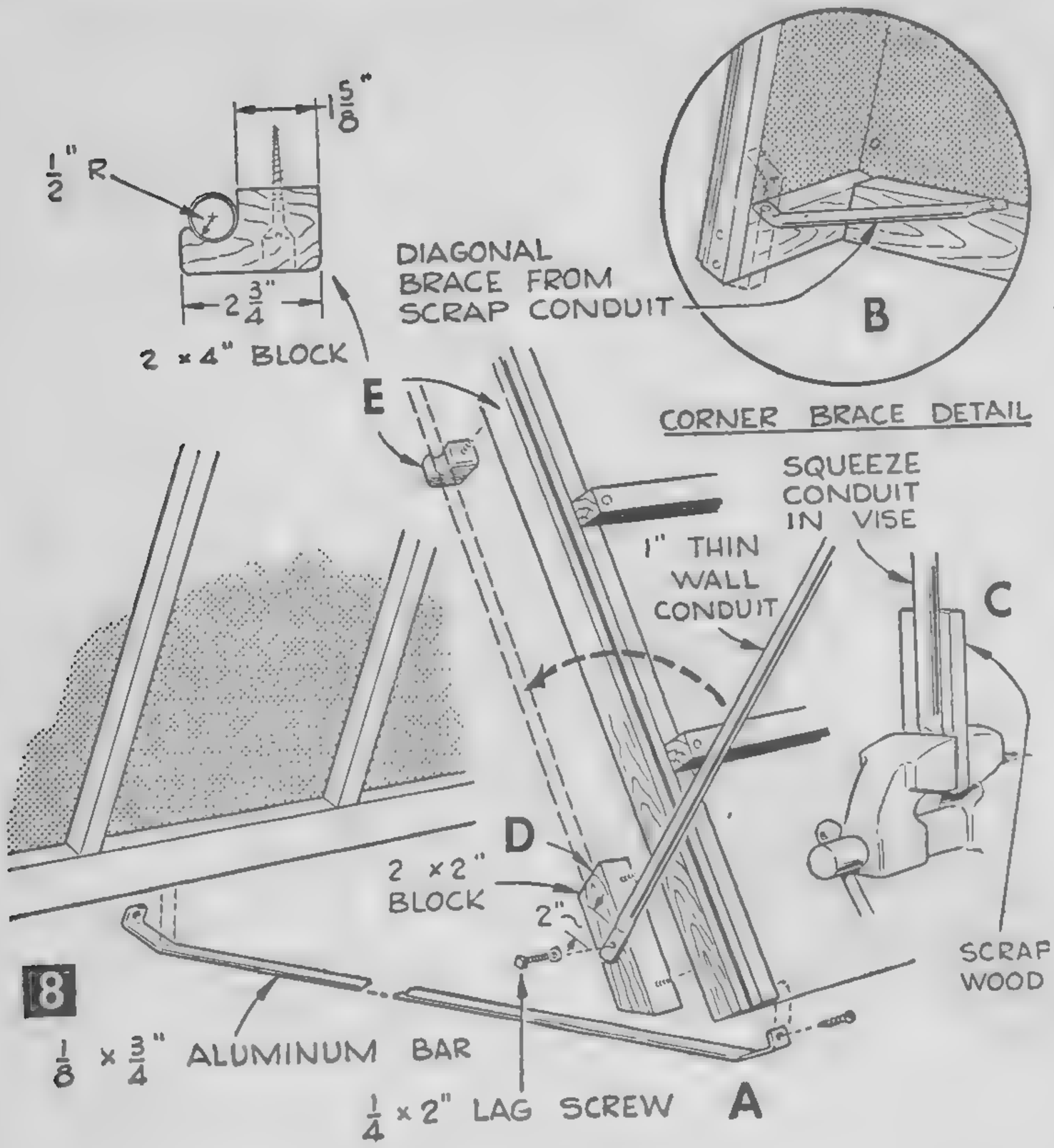
After the back framework is assembled, lay the lower exterior panel on it and nail in place. When nailing the two top panels, be sure the joint is centered over the center frame stud. Space the nails from 6 to 8 in. apart.

The front framework (Fig. 3) uses the same size top plate, studs, and sole. Nail the end studs to the top plate as you did in the back framework section. Then nail the door frame studs in place. A 47-in. wide 2 x 4 header is nailed between the door frame studs. Cut the 2 x 4 sole pieces to length and nail in place. After the other 2 x 2 stud is cut and nailed, re-inforce the framework with 2 x 2s that will fit between the studs.

Nail the panels to front of the frame, again spacing the nails from 6 to 8 in. apart.

Since the Door Panel (Fig. 4) will get plenty of rough treatment, the 2 x 2 framing is spaced closer together with short cross braces between the studs. Allow a ½-in. overlap on each side of the frame when attaching the panel. This forms a tight fit when the door is closed.

Instead of using roofing nails to put the panel on the door, use #8 x ¾-in. wood screws about every 8 in. Countersink the screw heads approximately 1/16 in. and fill with wood or plastic filler, sanding off the excess filler.



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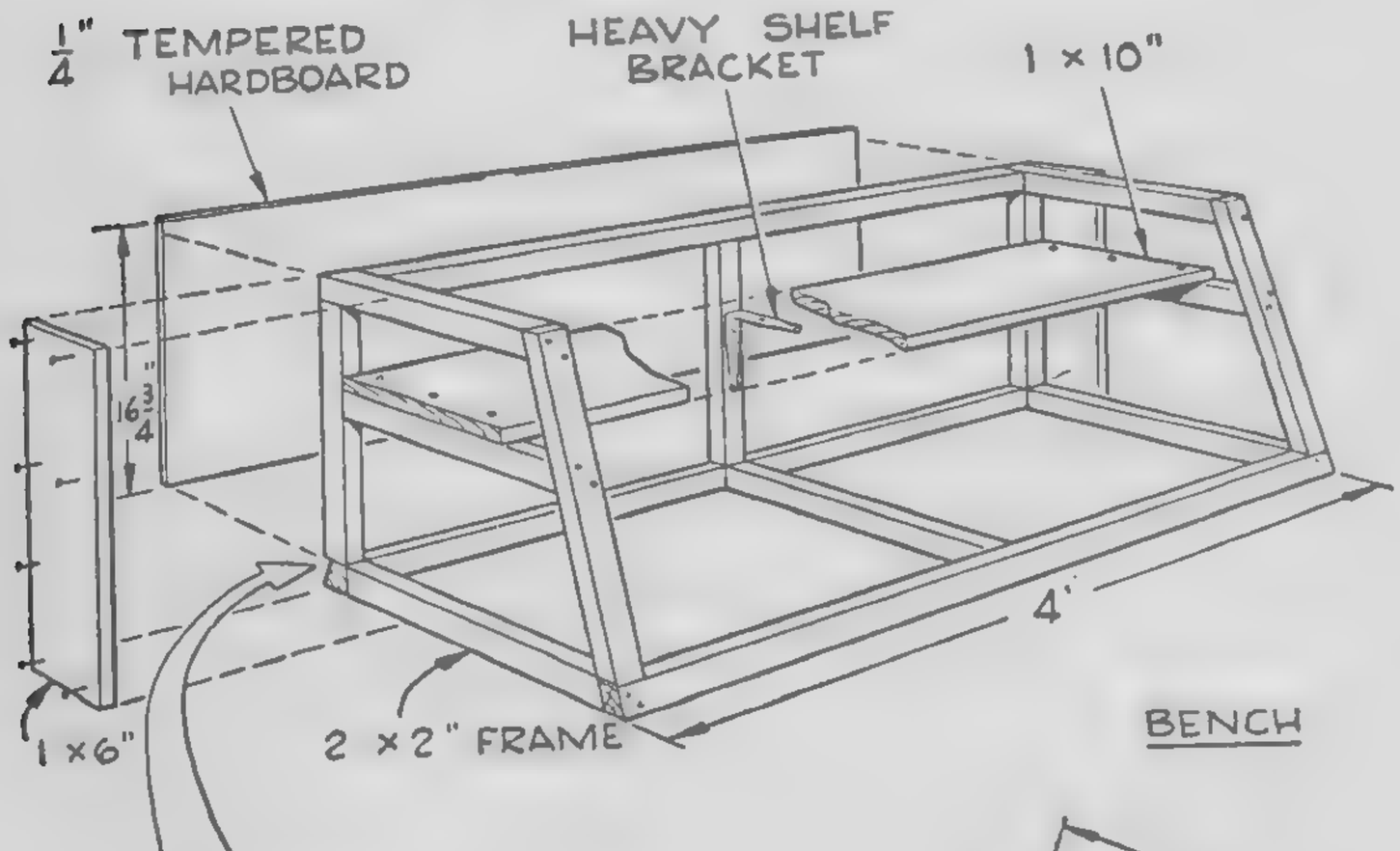
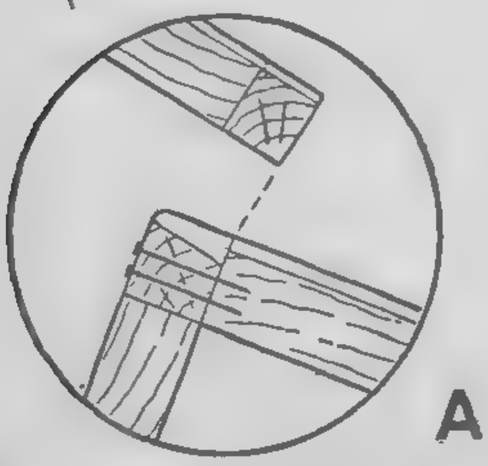
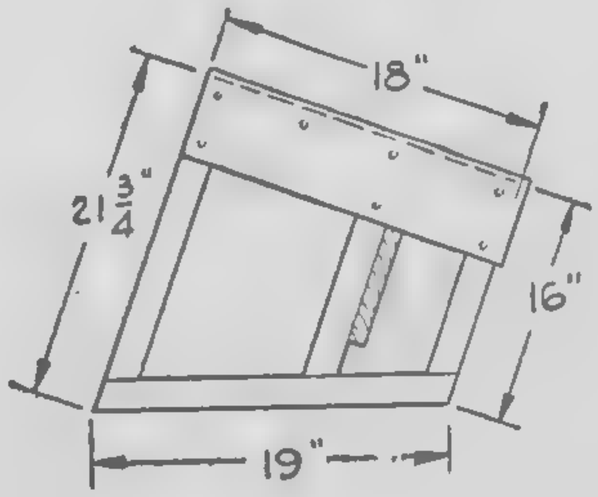




9. NOTCH BASE FOR DOOR SLIDE



SLIDE BASE

To hang the door in the front panel (Fig. 5), turn the framework so the top edge is on the ground and rest it against a wall.

Position the three brass hinges on the front panel header and notch the edge so the hinges lie flush with the frame (Fig. 5A). Screw-fasten the hinges in place.

Put the door panel face down on a box about the same height as the header in the front panel, and mark the locations where the hinges will be attached.

Before you screw the hinges in place, insert a strip of inner-tube to cover the joint between the door and the header. The rubber strip should fit between the frame and the panel and protrude approximately 1½ in.

The End Panels are Next (Fig. 6). Use your pre-cut panels as a pattern to determine the correct length of your framing material.

When marking the 2 x 4 sole for length, the panel should be 1½ in. from the bottom of the sole. Put a 2 x 2 at the top of the panel and mark off the correct length. Assemble this framework in the position it will appear in the panel and mark off the length of the 2 x 2 stud. Toenail the stud to the center of sole and nail through the top plate into the stud. Space the nails 6 to 8 in. apart when nailing the panel to the frame. Do not notch the end panels until they are completed.

Put the end panels in position between the front and back sections and mark off the angle of the notch (Fig. 6A).

Screws hold pre-assembled panels, which separate for easy transportation.

Allow an extra ¼ in. for overlap when you saw out these notches.

Attach the 1 x 2-in. outer battens to the front, back, and end panels with 8*d* galvanized common nails, that are staggered 6 to 8 in. apart.

Next step is to make the steady bar that is mounted to the roof board. Saw the 2 x 4 blocks (Fig. 7) to shape for the steady bar. Use a 1-in. drill bit to bore completely through the two center blocks and half-way through for the end blocks. Fit the 1-in. conduit into the blocks and screw-fasten them to the top board. Use #12 x 2-in. flathead wood screws.

To Assemble the Storage Unit, fit the end panels in place, and attach them to the front and back frames with #10 x ¾-in. wood screws.

Hold the top board and the steady bar section in place by screw fastening it to the front and back panel frames with eight #12 x 2-in. wood screws spaced roughly 18-in. o.c.

Fasten the ladder threads 12 in. apart with #14 x 3-in. screws that go through the outer battens and panel and into the framework. Countersink each screw about ¼ in. and cover with a filler.

To keep the front panel from spreading (Fig. 8A), screw fasten a ⅛ x ¾-in. aluminum bar from the front to the back panel. From a scrap of conduit after you cut your door posts, make a short diagonal brace for the narrow front panel (Fig. 8B).

For the Door Posts, use two 4-ft., 9-in. lengths of 1-in. conduit. Flatten one end of each pole for a length of 2 in. (Fig. 8C), then drill a ¼-in. hole 1 in. from the end for a ¼ x 2-in. lag screw.

Screw-fasten two short pivot blocks (Fig. 8D) to the inside door frames with #14 x 3-in. wood screws. Then lag screw the conduit posts to the pivot blocks. When the door is open, the top end of the posts will fit just behind the next to the lowest frame member of the door panel. When closed, the pivot post swings back inside the door frame out of the way.

To hold the door posts in place after the door panel is closed (Fig. 8E), make a notch in one end of a short block the size of your conduit and screw-fasten it to the inside of the door frame about 36 in. above the pivot blocks.

Finish off your combination storage shed and playhouse by constructing the bench from your remaining lumber (Fig. 9). After cutting the material to length, bevel the lower cross frame member (Fig. 9A) so the door can rest on it to form a section of the slide.

The ¼-in. back panel of the bench becomes the lower portion of the slide when the bench is turned over on the sloping front frame.

Additional support is added to the bench by using a heavy shelf bracket at the center of the 1 x 10 seat section. Further bracing is accomplished by using 1 x 6 lumber at the ends.

Weatherproof the storage unit for year 'round storage by covering the opening above the end panels with a plastic film of the type sold in storm window kits.

MATERIALS LIST—
PORTABLE STORAGE-PLAYHOUSE UNIT

No. Req.	Size and Description	Use
11 pc.	4 x 8′ tempered hardboard	exterior panels
11 pc.	2 x 2″ x 8′ fir or hemlock	frame plate
20 pc.	2 x 2″ x 6′ fir or hemlock	frame studs
2 pc.	2 x 4″ x 8′ fir or hemlock	sole and header
1 pc.	2 x 4″ x 10′ fir or hemlock	sole
1 pc.	1 x 8″ x 8′ fir or hemlock	roof board
1 pc.	1 x 10″ x 4′ fir or hemlock	bench seat
1 pc.	1 x 6″ x 4′ fir or hemlock	side bench braces
10 pc.	1 x 2″ x 6′ fir or hemlock	battens
1 pc.	1 x 2″ x 8′ fir or hemlock	battens
16 ft.	1″ conduit	door posts
3	heavy duty brass hinges	door
1 lb.	1½″ galv. roofing nails	panels
1 lb.	8*d* galv. common nails	battens
1 lb.	16*d* galv. common nails	framework
28	#8 x ¾″ *fh* wood screws	door and panels
12	#1 x ¾″ *rh* wood screws	panels
16	#12 x 2″ *fh* wood screws	roof board
24	#14 x 3″ *fh* wood screws	ladder threads
2	¼ x 2″ lag screws	door posts
1	8″ heavy shelf bracket	bench
6 ft.	⅛ x ¾″ aluminum bar	bracing

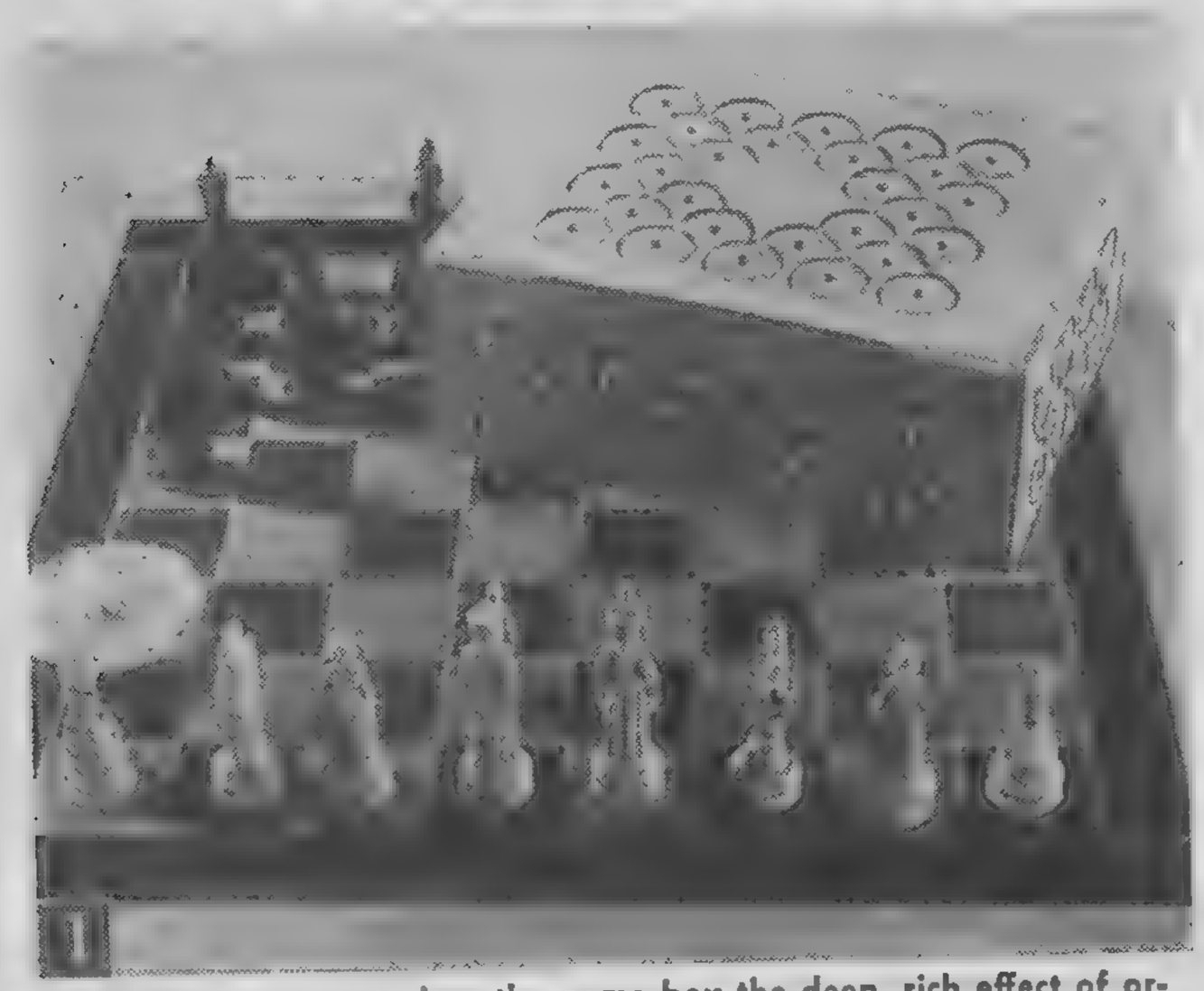
PAINTING SUGGESTIONS

Old Gold Exterior Enamel—Front, back, door, end panels, and slide extension panel

Light Gray Exterior Enamel—Interior, and Frame of seat and slide extension

Charcoal Grey Exterior Enamel—Batten, ladder rungs, steady bar brackets

Decorative Cuts with Common Shop Tools



Fly-cutter treatment gives the game box the deep, rich effect of ornate carving. Hardboard-surfaced plywood used was left unfinished.

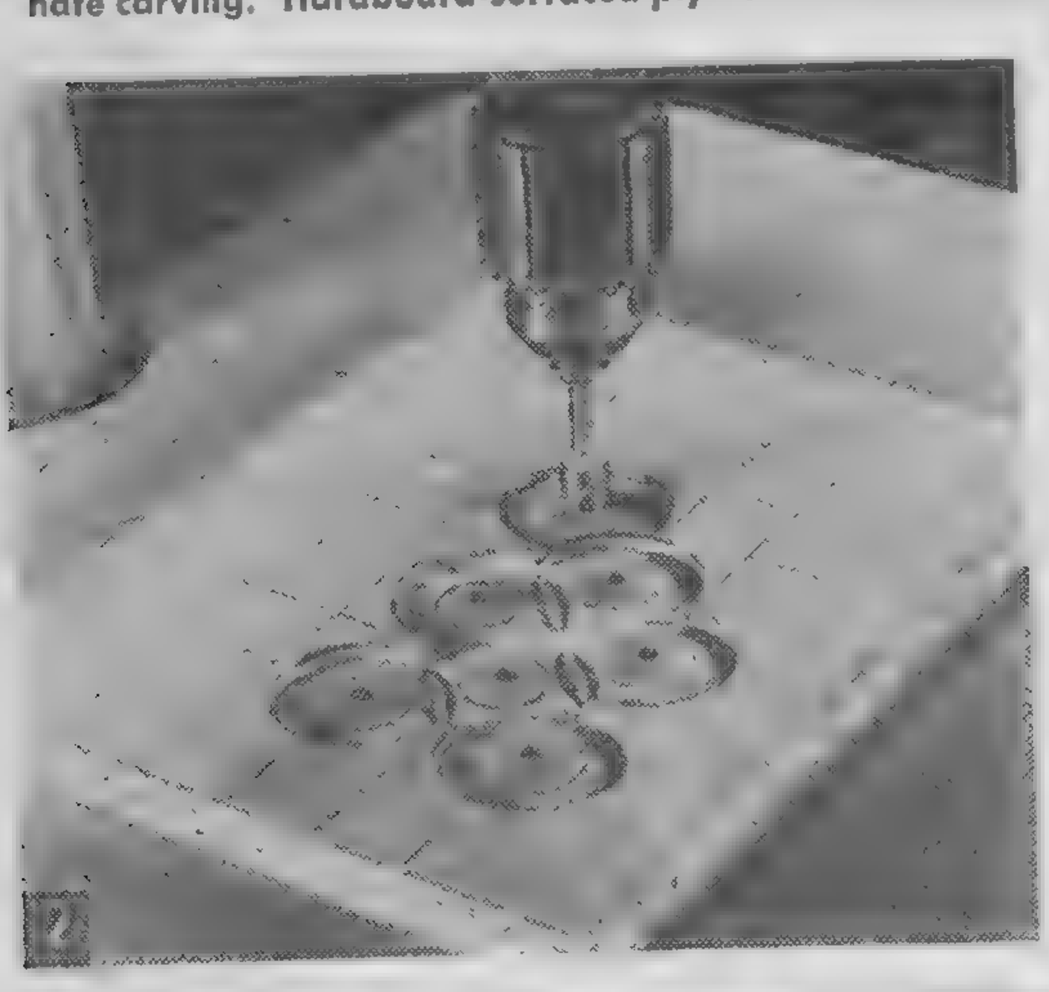
How to simulate intricately carved patterns using ordinary drill press and saw attachments

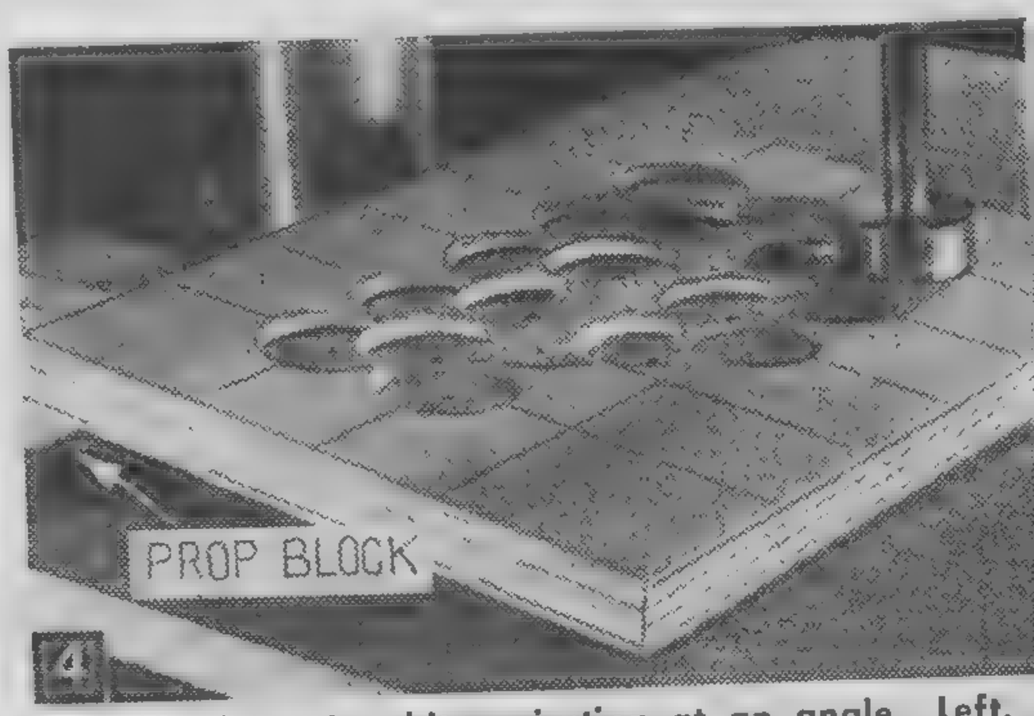
By R. J. DeCRISTOFORO

REPETITIVE patterns easily cut with many conventional shop tools can make conversation pieces out of simple woodworking projects.

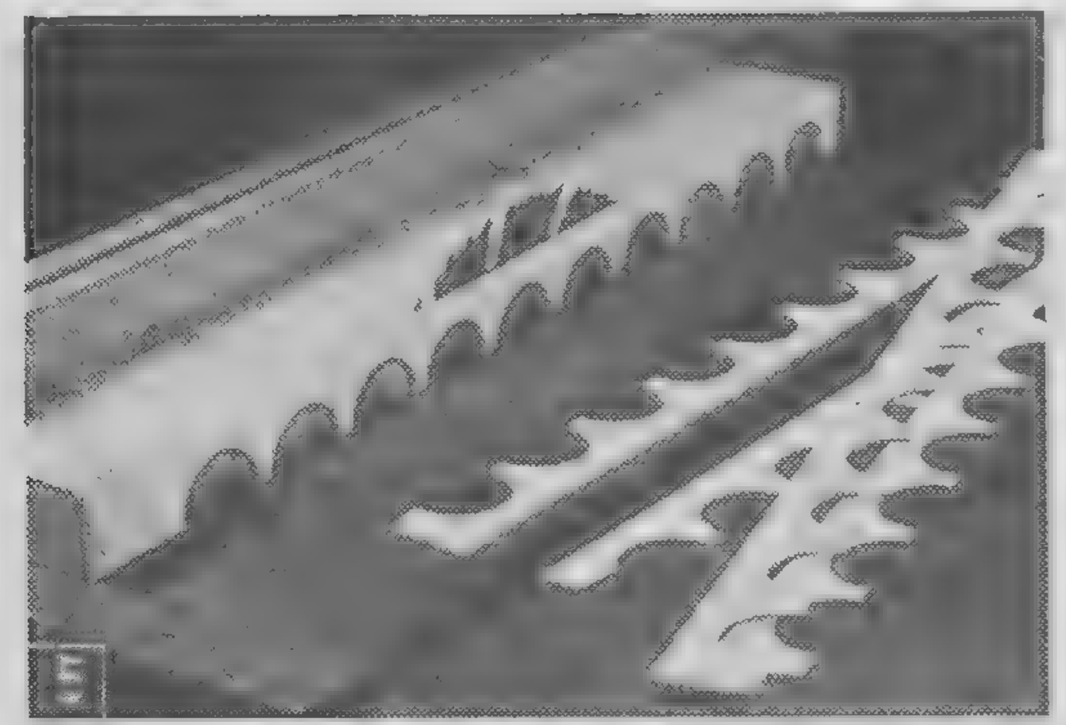
What appears to be intricate carving, such as that on the game box in Fig. 1, is the work of a fly-cutter. With this and other common tools, you can emboss, scallop, pierce or striate wood and hardboard to create more attractive panels, cabinets, cases, moldings, picture frames and trim of all kinds.

Raised Cones. The particular fly-cutter used to make the attractive box sides (Fig. 12) differs from the usual type in that it has a cutting bit that projects from the shaft at a slight angle. Called an *Adjust-A-Drill,* it leaves a raised cone when depth of cut is





Three surface treatments. Above, left, the raised cone, made with cutting bit projecting at an angle. Left, inverted cone, which can be "dimpled" by an ordinary countersink in simple or elaborate pattern. Right, cutting sloped scallops on tilted work with a multi-spur bit.



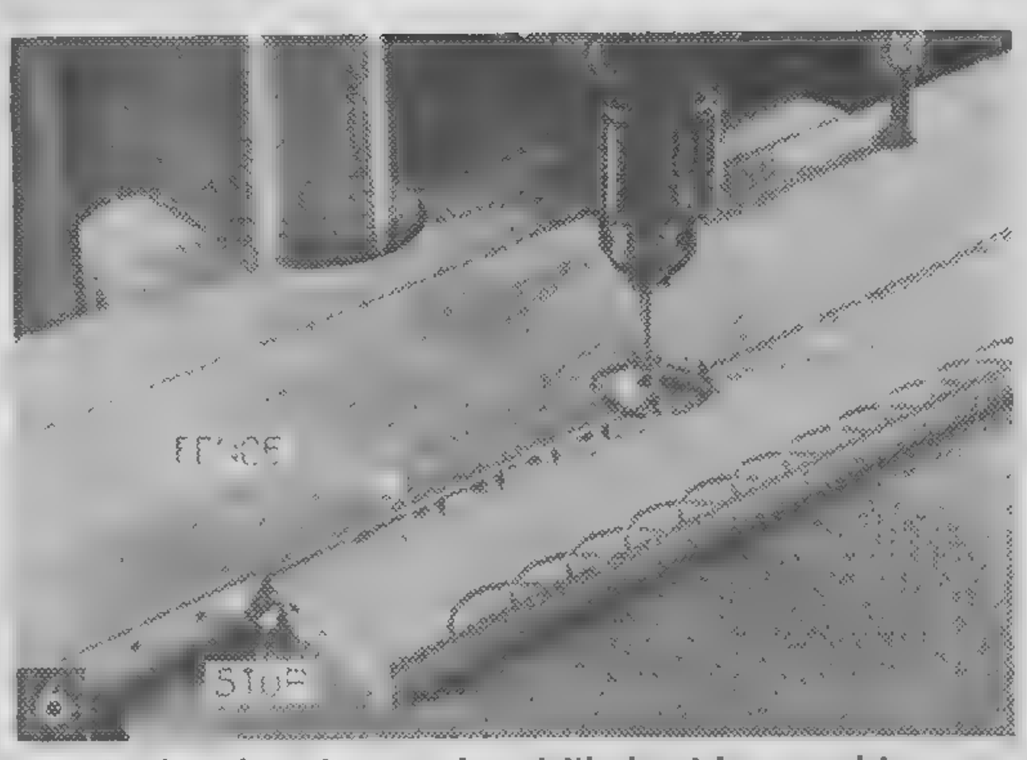


Table saw strip-cutting lengths of scalloped molding from work that has been edge-drilled with a multi-spur bit. At right, angle-bit fly-cutter "embossing" design for molding strip. Holes evenly spaced in side of fence guide each cut. Stop is nail with head cut off.

limited. To increase the deep-carving effect, overlap circles as in Fig. 2, which will provide faceted areas and cut into the basic cone.

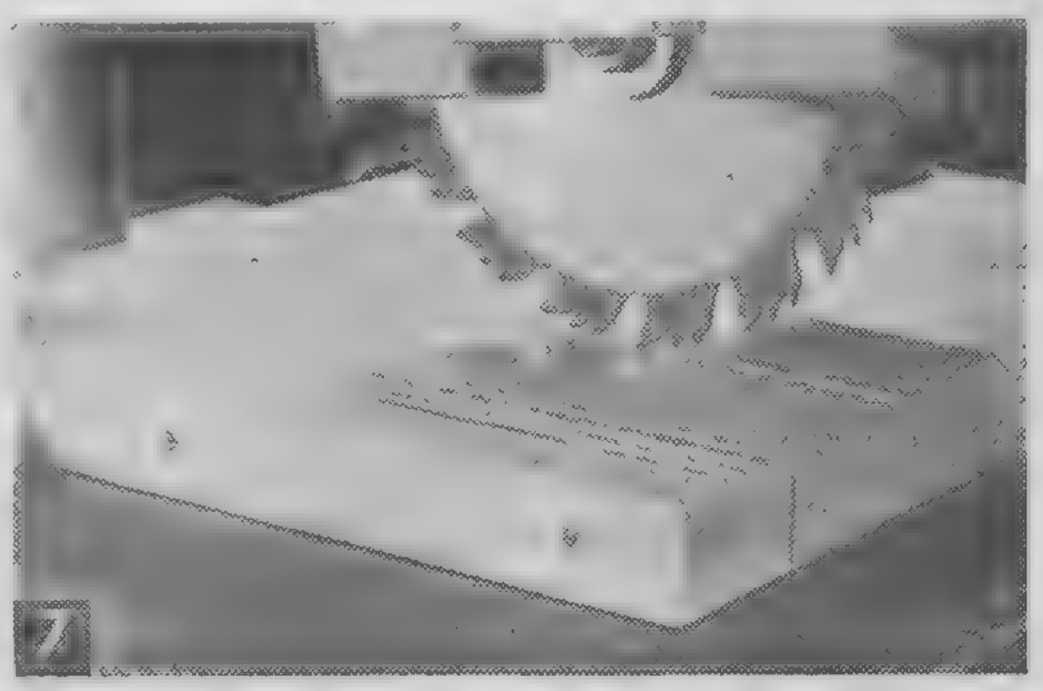
Since this and other type fly-cutters have a pilot drill, a center hole becomes part of your design. You can dress it up with a countersink, or eliminate it altogether by grinding down the drill point so that the only thing cutting is the bit. If you do this, be sure to clamp work securely for each cut. Either way, use a slow drill press speed and feed the cutter steadily into the work.

Inverted Cones. A single countersink doesn't resemble much, but a series of them (Fig. 3) produces an intriguing decoration. You can obtain good contrast for the finished job by staining the entire surface, including countersinks, then sanding the surface thoroughly so only the dimples retain the stain. If drill-press capacity is too limiting for the work you want to handle, use countersink in a portable electric drill.

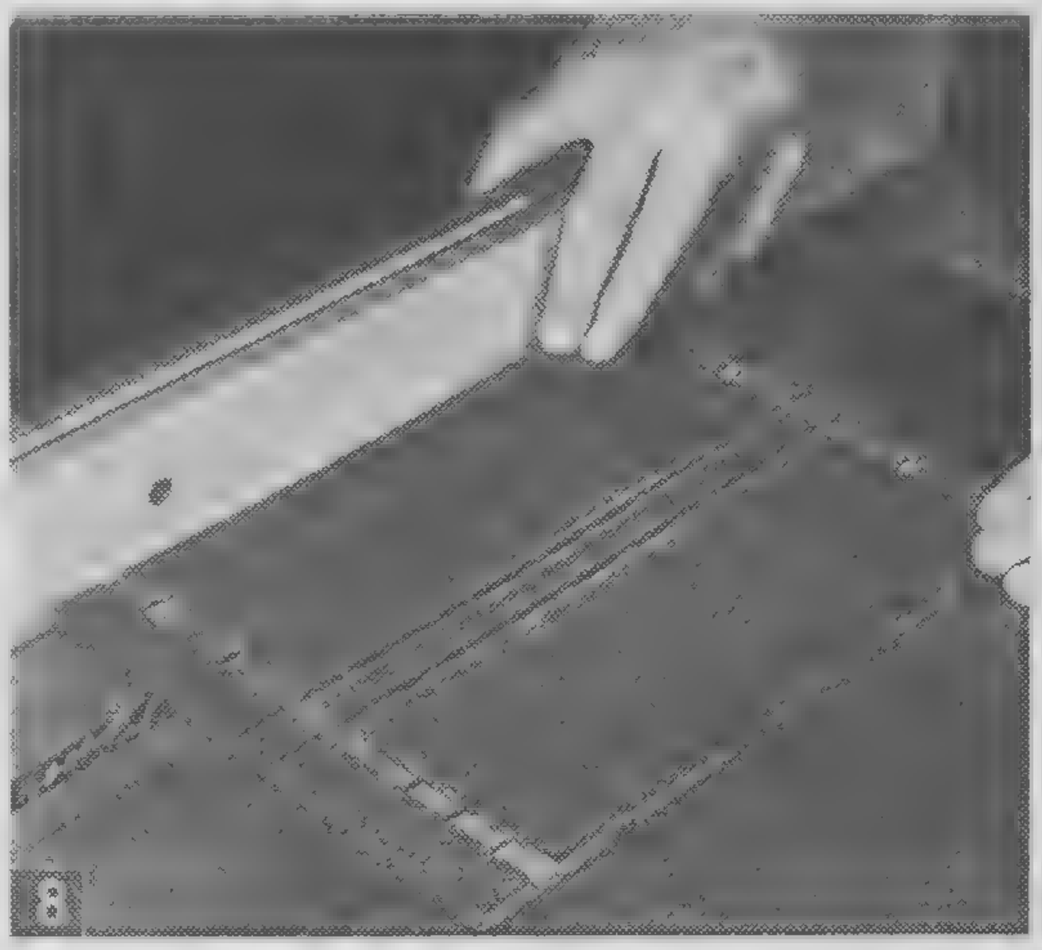
Sloped Scallops. A multi-spur bit producing a flat-bottomed hole doesn't create very interesting designs on a flat-surface, but if you'll slope the work a bit as in Fig. 4, the overlapping circles will end up as multi-leveled scallops. As you move the work back, be sure to adjust depth of cut of the bit.

Strip-Cut Moldings. With the multi-spur bit, you can also cut a section of a hole by drilling close to the edge of stock. By drilling a series of holes and then strip-cutting the work on a table saw (Fig. 5), you can produce interesting moldings which need little finishing if you use a hollow-ground saw blade. Work with short or long pieces of stock, depending on ultimate use of the decorated pieces. For more intricate designs, form half-holes on each edge of the stock or change the centerline of alternate holes.

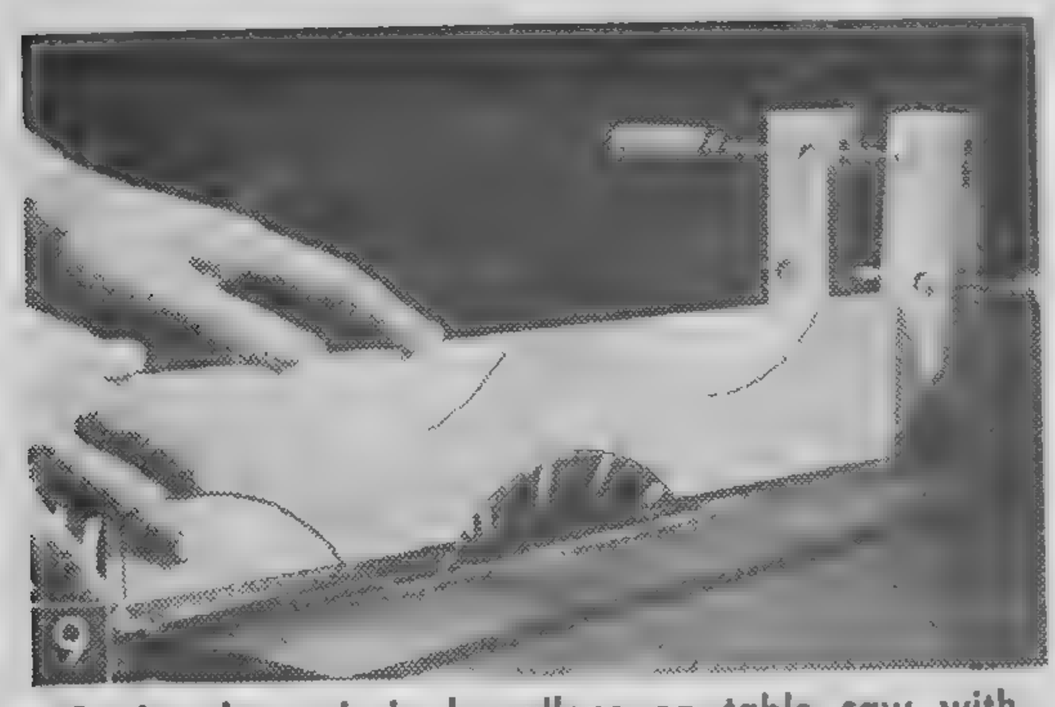
Embossed Moldings for picture frames or other uses call for use of the angled-bit fly cutter, but work only on the stock edges as in Fig. 6. This requires a fence and a stop that can be set to space the cuts. Select a long straight board and joint one edge. Then drill a series of holes in that edge spaced about one inch apart. You can suit the spacing to your own requirements after you've had a chance to experiment for different effects.



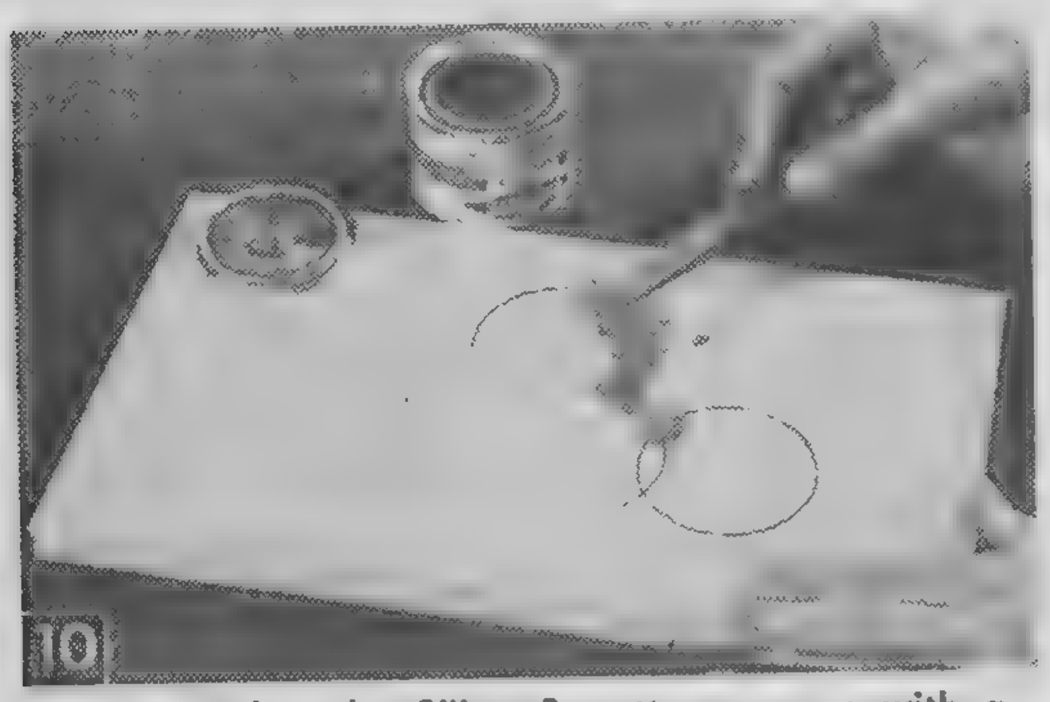
Ordinary saw blade with set teeth does a good striating job on either radial arm or table saw.



Ordinary saw blade or dado assembly is set for height little more than half thickness of the work. A type of panel "piercing" occurs when desired cuts are made on both surfaces.



Cutting large incised scallops on table saw with aid of rip fence and clamp used as stop block. Saw cuts own thickness in stock.



Forming inlays by filling fly-cutter grooves with a plastic wood. Inlay at right was formed by strip of soft aluminum forced into the groove and sanded smooth.

Clamp the fence to the drill-press table so the center pilot of the fly cutter won't hit the work. Then it's a matter of setting depth of cut and using a nail in the guide holes to set the spacing between cuts.

Striated Surfaces. Even an ordinary saw blade can be utilized to do more than just cut through wood. Figure 7 shows one striating a surface. It's just a question of running the blade back and forth as you move the stock. A blade with set teeth does this job best, with depth of cut *very, very light*. You can do this faster on a radial arm saw but a table saw will be satisfactory.

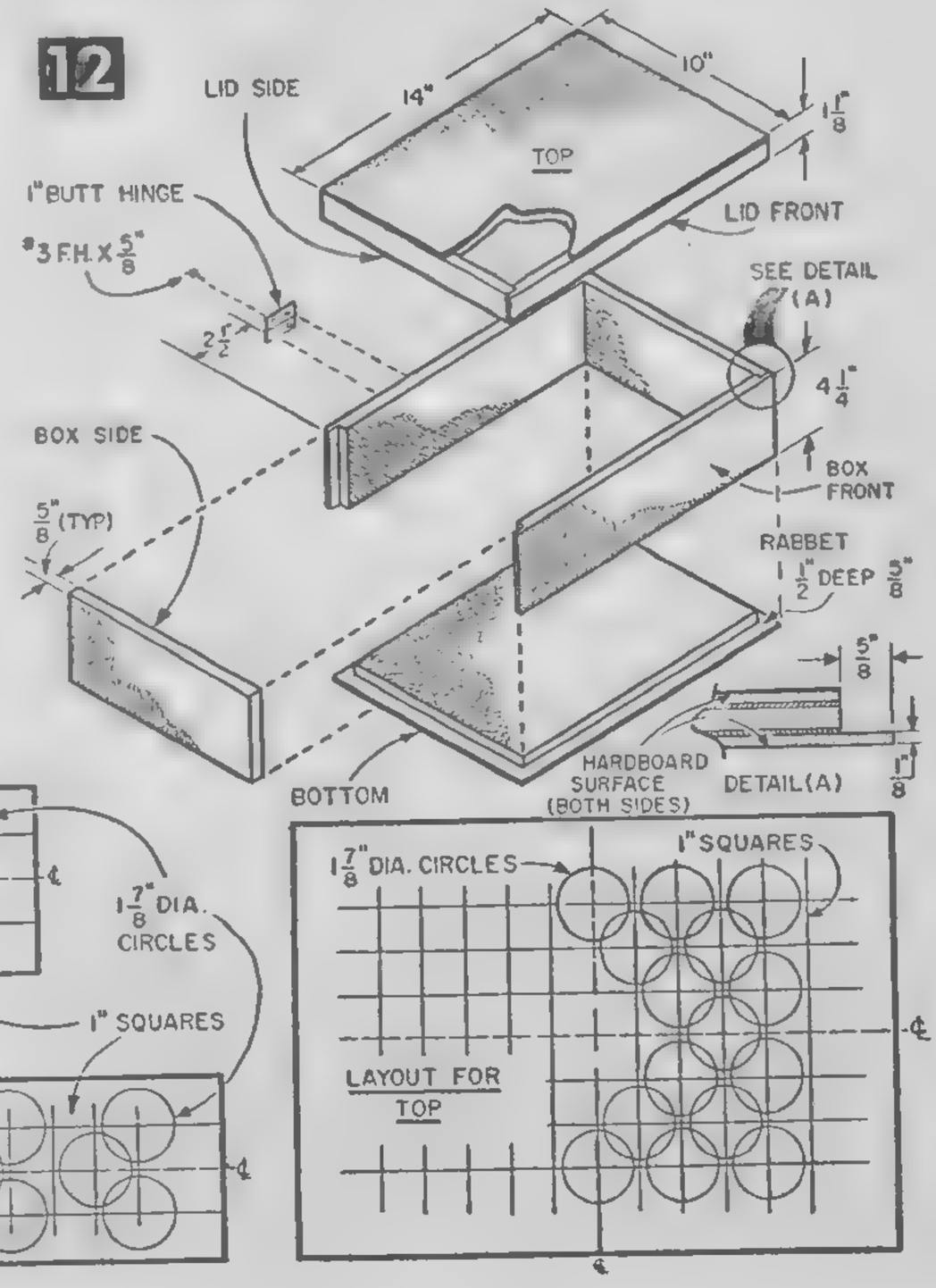
To vary the texture, change depth of cut a little as you work; also change distance between cuts.

Pierced Paneling. If you set a saw blade (or a dado assembly, for that matter) to a height little more than half the thickness of the stock, and then make passes on both sides of the work (Fig. 8) you will pierce the work where cuts cross

Here's a useful way to "let off steam." Random pounding with a ball peen hammer gave this outdoor bench an "antique" finish.

MATERIALS LIST—GAME BOX

No. Req.	Size and Description
2 pcs.	5/8 x 10 x 14" (top, bottom)
2 pcs.	5/8 x 4 1/4 x 14" (box front, back)
2 pcs.	5/8 x 1 1/8 x 14" (lid front, back)
2 pcs.	5/8 x 4 1/4 x 9 3/4" (box sides)
2 pcs.	5/8 x 1 1/8 x 9 3/4" (lid sides)
Above pieces can be cut from 2 x 3' panel of 5/8" hardboard-surfaced plywood or plain hardboard	
Misc.	pr. 1" butt hinges, 8 #3 x 5/8" *fh* wood screws, finishing nails, glue



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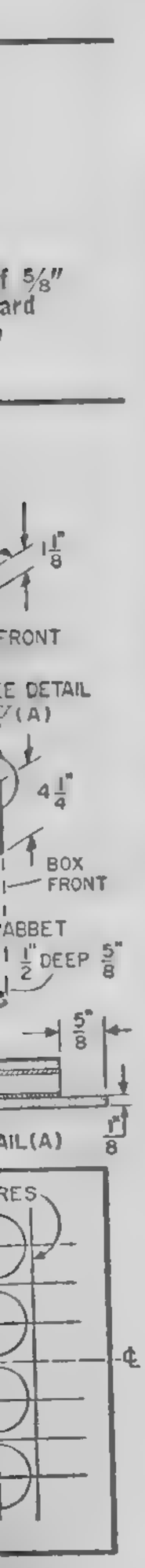


and form square holes that combine with the grooves to form a pattern. The airy effect achieved is especially good for breaking up a large expanse of panel in a divider or in a sliding door.

Lined with a translucent material such as fiber glass, small panels treated like this can be used as fixtures for atmosphere lighting—indoors or out.

Incised Scallops are formed with a saw blade as in Fig. 9. Set the rip fence so the distance between fence and outside surface of the blade equals thickness of the stock. Butt the work against the screw-clamp stop block, then slowly lower it over the turning blade. For the smoothest cuts, use a hollow-ground blade, but lower the work slowly if you want to avoid burning either the blade or the work.

Perfect Inlays are easy to prepare if you form the circular grooves with a conventional type fly cutter as in Fig. 10. Be sure to set the bit so it will contact the work before the center pilot. If you clamp the work and keep the drill-press speed slow, the grooves formed will be uniform and smooth.

Fill grooves with a contrasting plastic wood, let this dry hard and then sand the surface for a perfect inlay. You might also fill grooves with copper wire. Form a shallow groove so you can force the wire in place; then sand off the surplus.

If you want an irregular line instead of a perfect circle, substitute a router for the fly-cutter.

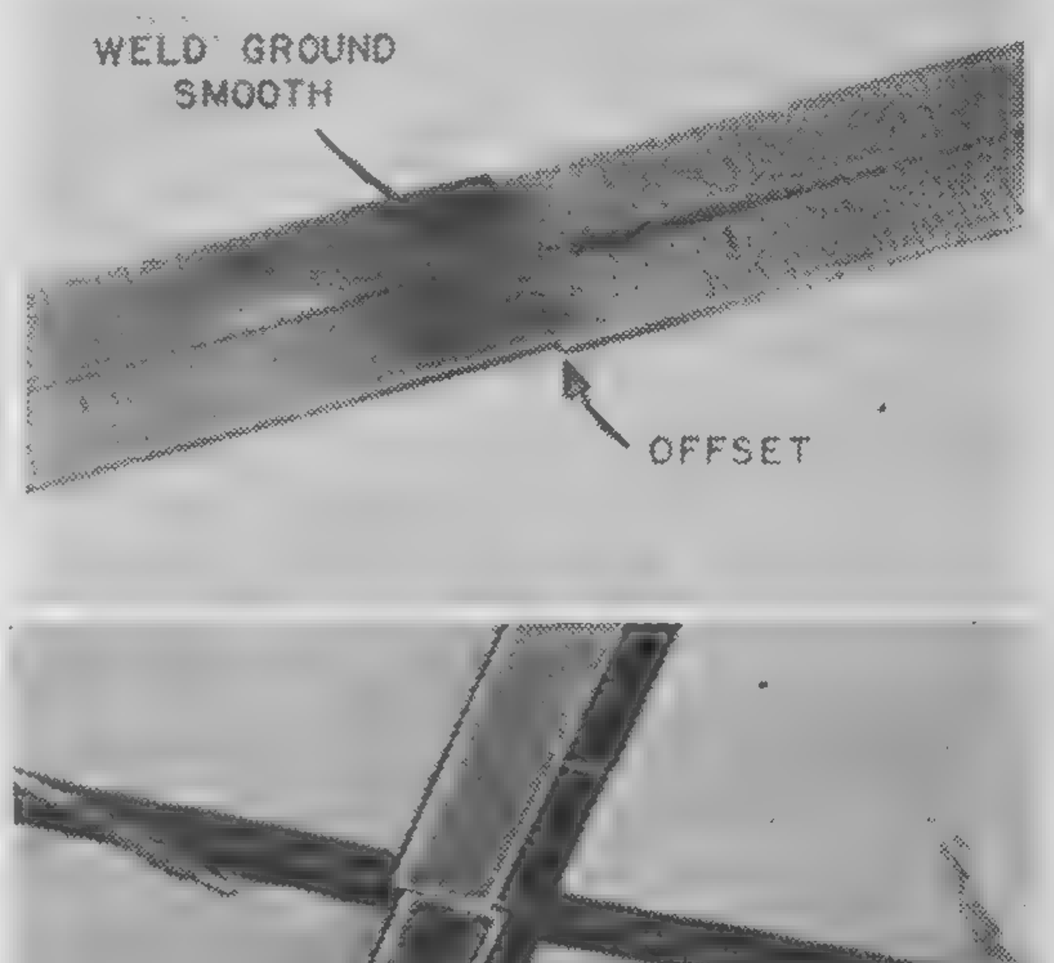
Use Almost Any Tool to enhance a project. To prove this, we whacked away at a garden bench with the round end of a ball peen hammer as in Fig. 11, applied a stain and then sanded it lightly. The finish attracted such attention, many neighbors wanted to know where we obtained the antique wood.

Building the Game Box. We made the game box shown in Fig. 1 out of 5/8-in. hardboard-surfaced plywood, which is now available from many building supply and plywood dealers. It comprises 3/8-in. plywood sandwiched between 1/8-in. plies of hardboard. Plain hardboards are also satisfactory. If you use wood, it should be free of grain as in sugar pine or as dense as maple so that the grain will not spoil the fine cutting.

You can cut all the box parts specified in the Materials List from one 2 x 3-ft. panel. Rabbet top and bottom, also front and back pieces of box and lid, as in Fig. 12. Rule off top, front and side pieces in 1 in. squares as in Fig. 12 to establish pilot hole locations for the fly-cutter and make the decorative cuts. Back of box can be left plain or duplicate the front pattern. Assemble box with glue and 6*d* finishing nails. Set nail heads and fill holes with wood putty colored to the shade of the wood.

Centerline Scale for Layouts

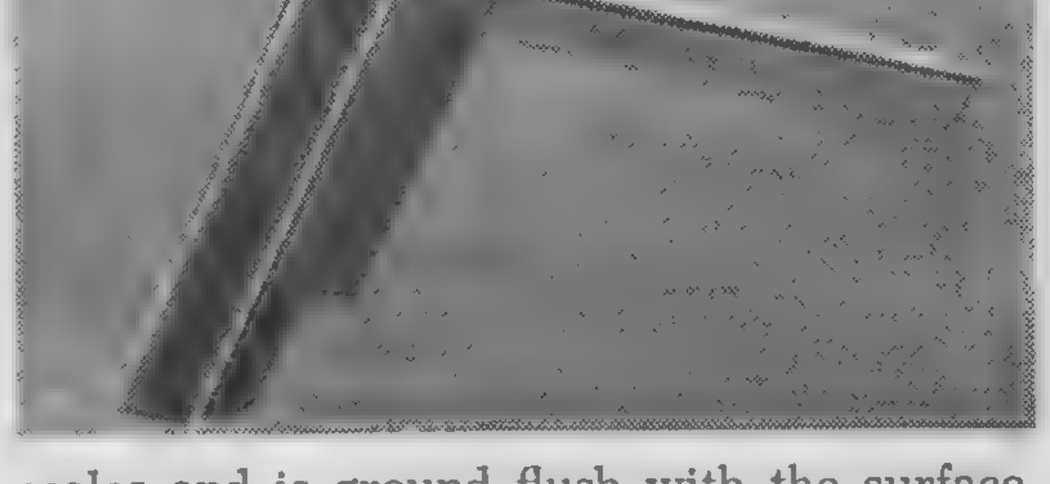
• Weld a pair of steel scales together, end to end, for use when laying out measurements on both sides of a centerline. Welding is done only in one small spot on the back of the



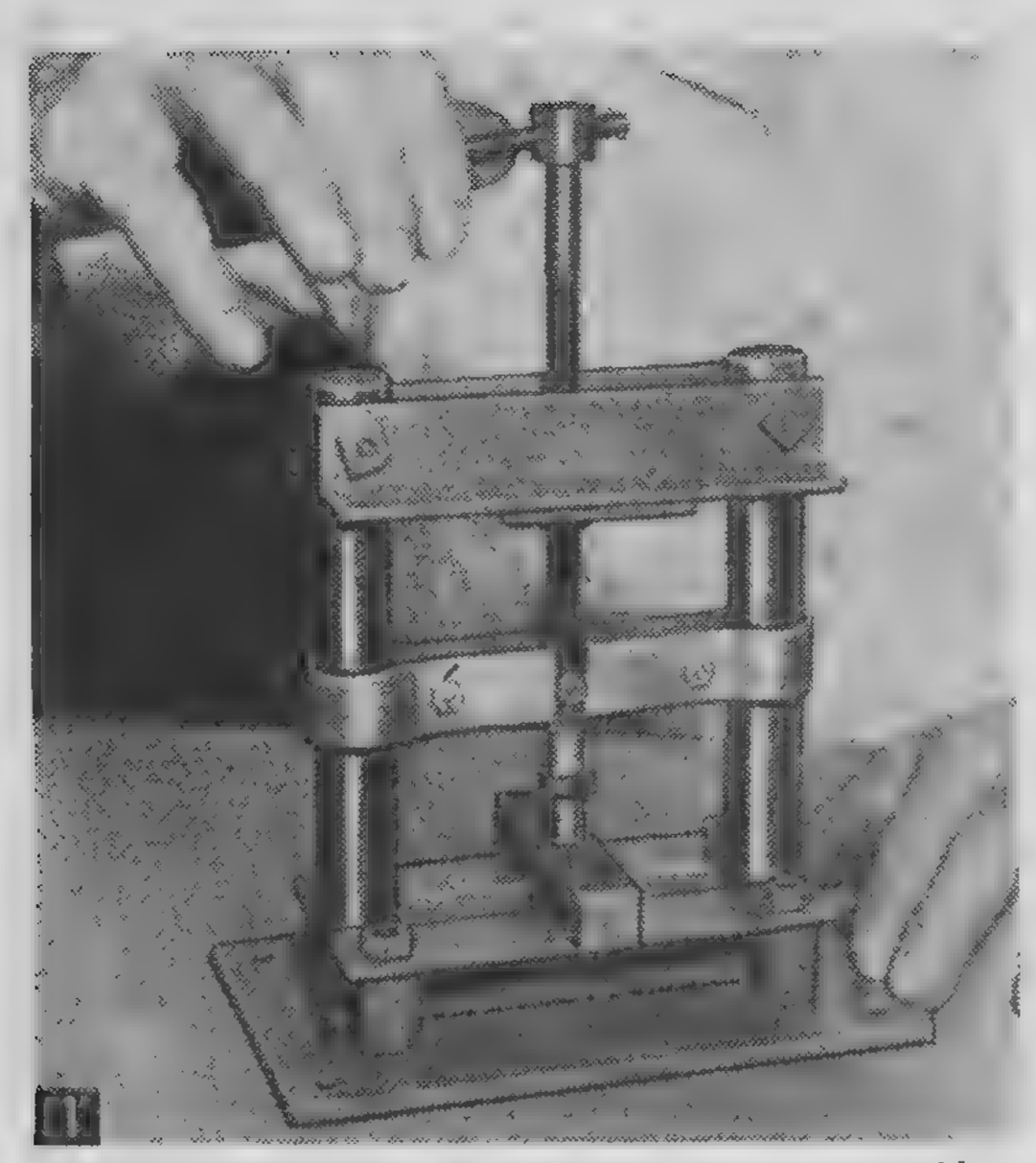
scales and is ground flush with the surface. The two rules are slightly offset so part of the end of each rule will protrude to permit the zero-point to be accurately aligned with the centerline of the work.—H. J. GERBER.

Custom Clamps and Vises

• Make miniature vises and clamps from hinges, using bolts and wing nuts to tighten them. You have a wide assortment of hinges to choose from to suit your needs. Or you



can cut and shape these for yourself for even more specialized uses. When working with finished or delicate materials, pad the clamping area with felt.—V. H. LAMOY.



Arbor spindle rides in sliding support to provide maximum accuracy and strength.

Modelmaker's Arbor Press

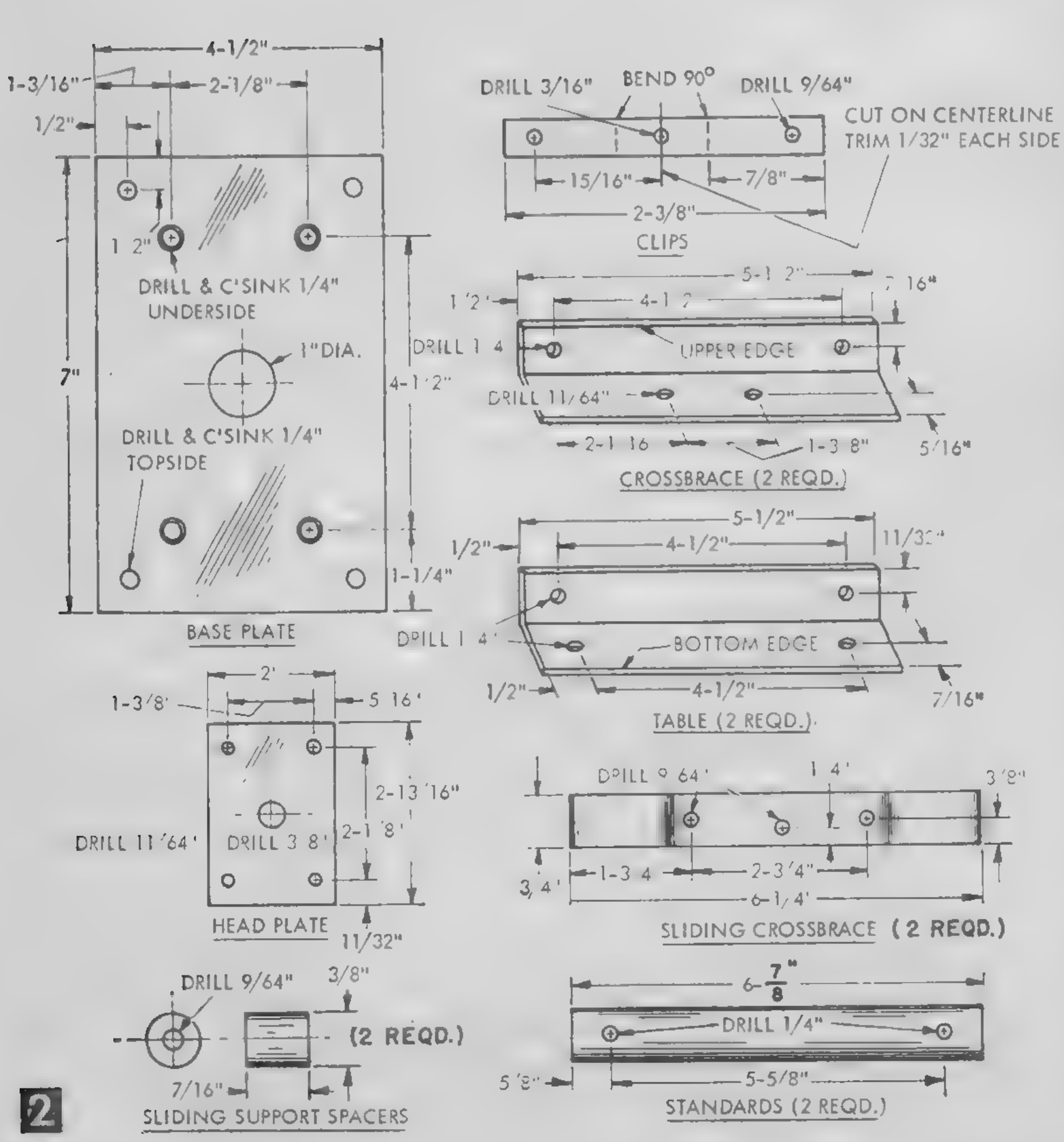
By HAROLD P. STRAND

DESIGNED for modelmakers and home craftsmen, this miniature press is the ideal tool for pressing out small bushings, assembling parts specified as press fit, and for shaping and bending light metals.

To make it, first lay out, cut and drill the parts as in Fig. 2. Drill a hole in the center of the base and enlarge it with a saw or file to provide a clearance hole beneath the work table.

Bolt the angle iron work table flush with the lower ends of the pipe standards. The surfaces of the table are made level by trimming ⅜-in. pipe spacers (Fig. 4) to length and bolting the table through them into the base plate. Bolt the crossbraces to the upper ends of the standards, square up the entire assembly, and drill holes for ⅛-in. drive pins just above the bolts in the crossbrace to keep the assembly square and rigid. Then weld a ⅜-16 hex nut to the center hole of the head plate (Fig. 4) and run a tap through it after welding to clear the threads. Fasten the plate to the underside of the crossbraces with four 8-32 *rh* screws.

Make up the spindle from a piece of steel rod as in Figs. 3 and 4. Mount it in a lathe collet and turn down one end ¼-in. dia. x ½ in. Round and polish the tip to a ¼-in. half-ball and make a 1/32 x 1/32-in.



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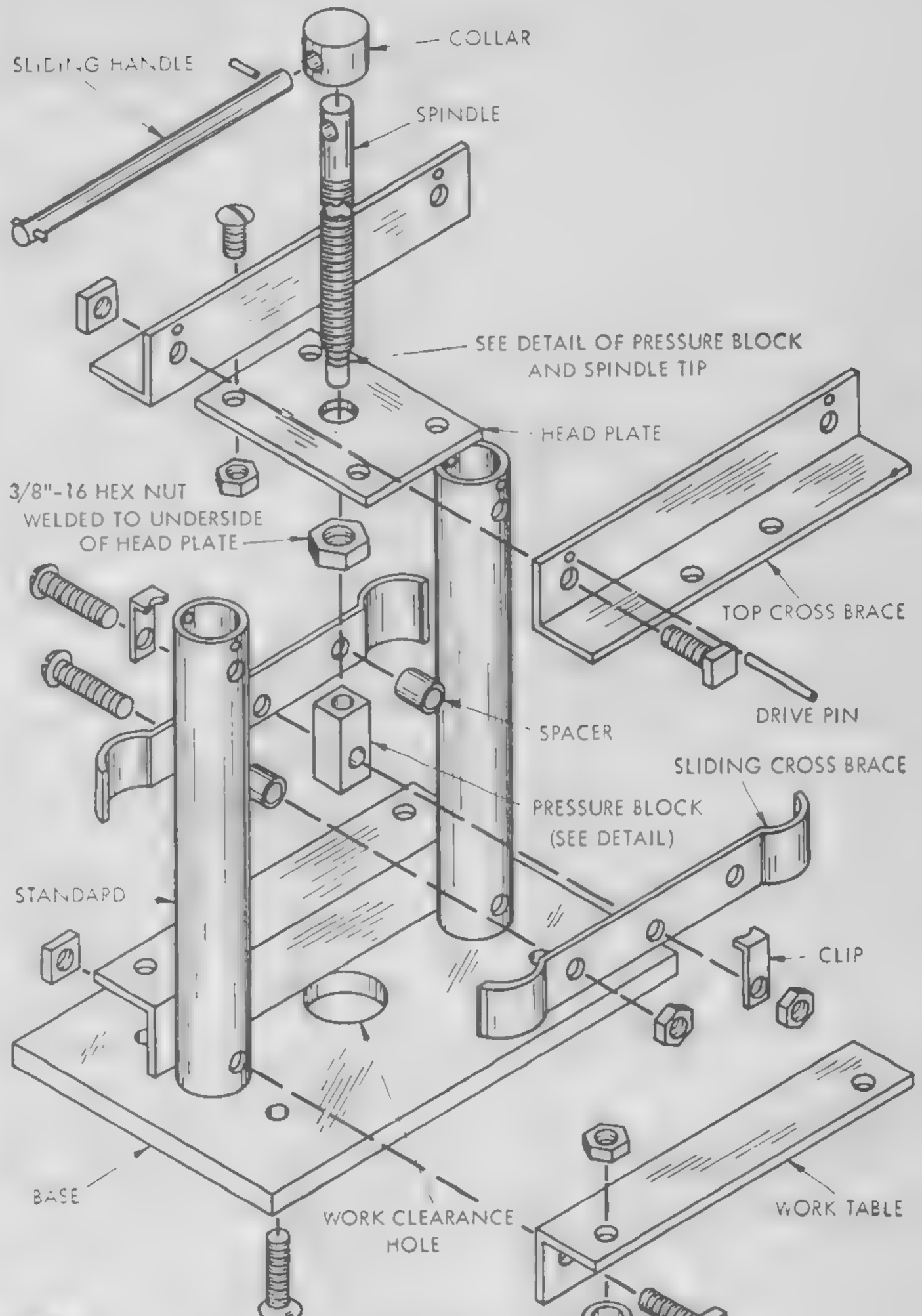
groove with a cut-off tool. Now thread the spindle ⅜-16 for a distance of 3½ in. from the tip.

Fit the top end of the spindle with a pressed-on collar (Fig. 4), turned and bored from a piece of ¾-in. steel bar. Drill a ¼-in. hole through the collar and spindle for the sliding handle. Also drill holes in the ends of the handle for steel drive pins to keep the handle in the collar.

The lower end of the spindle works in a steel pressure block assembly (Fig. 3). Case-harden the lower ends of the pressure block and the spindle by heating to cherry-red and then rolling them in a prepared case-hardening powder. Quench both parts in cold water.

The pressure block is carried in the center of the arbor by a sliding support, bent up from 1/16-in. strip steel. Form the ends around the pipe standards (Fig. 4), providing space between them for the pressure block. Smooth the standards and supports with 9/0 emery cloth and finish the spacers to length so the support slides freely on the standards.

Make two clips from a piece of clock spring (Fig. 2), formed so their ends fit in the groove of the spindle. First anneal the entire piece of spring stock. Then lay out and drill as in Fig. 2 and bend it along the dotted lines. Finally cut and



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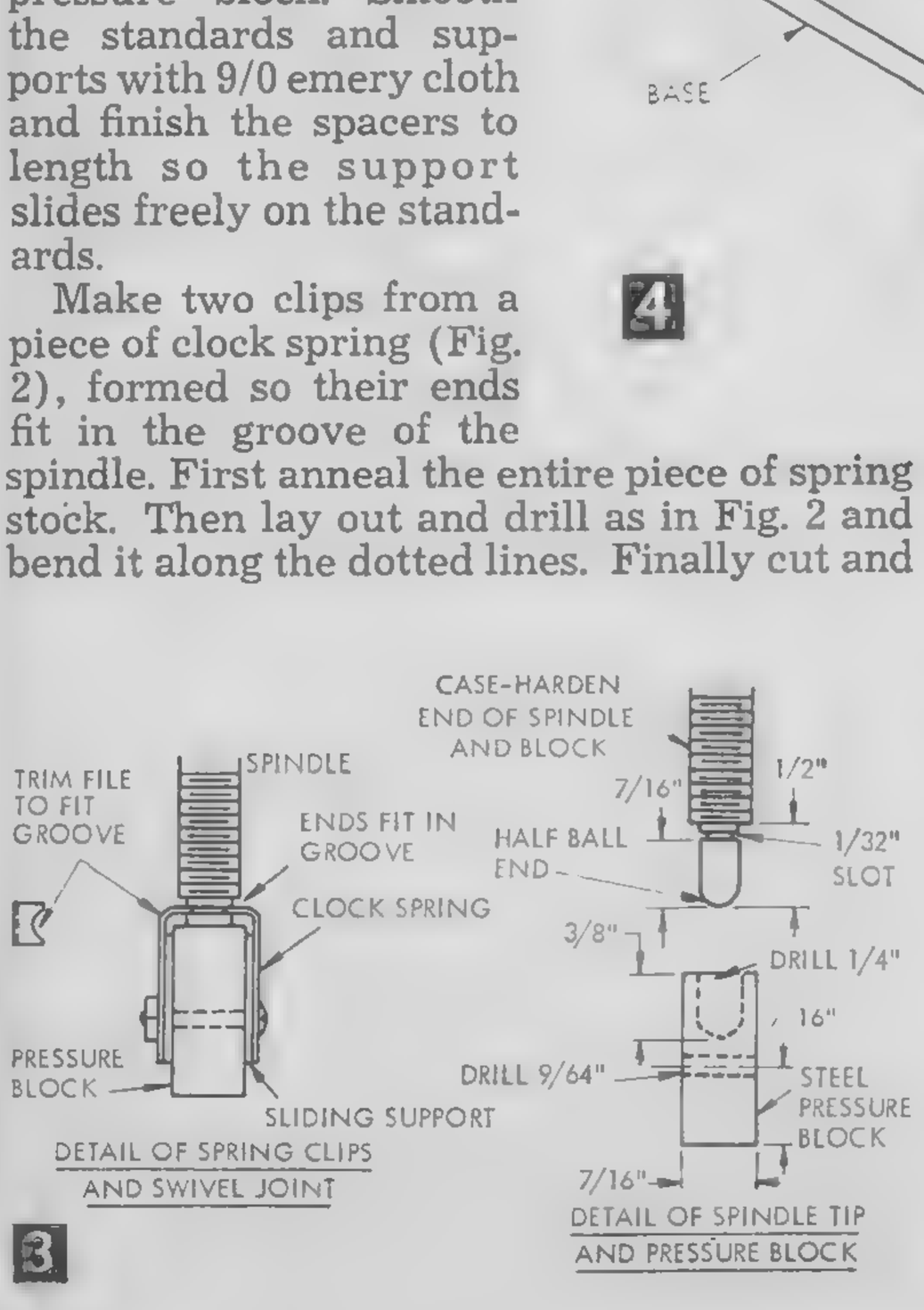

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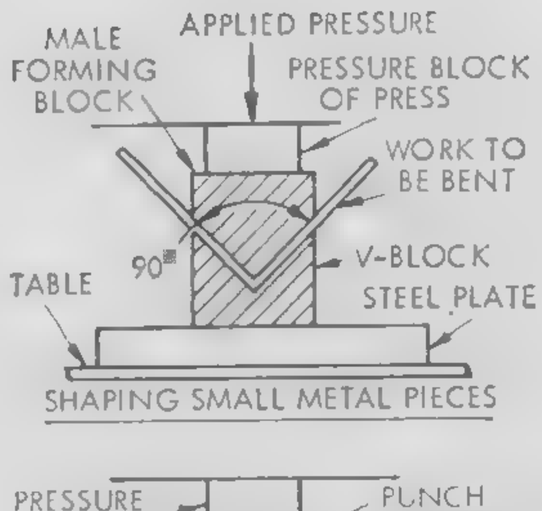
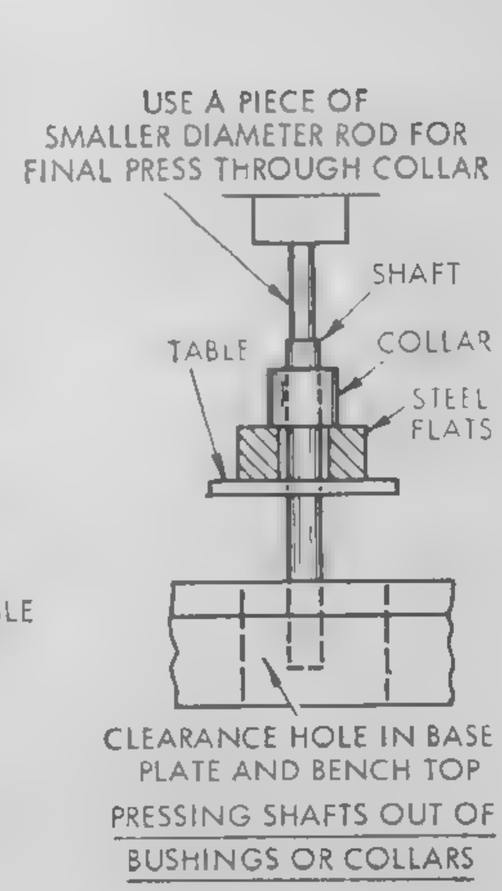




5 A FEW SUGGESTED USES

MATERIALS LIST—
MODEL MAKER'S ARBOR PRESS

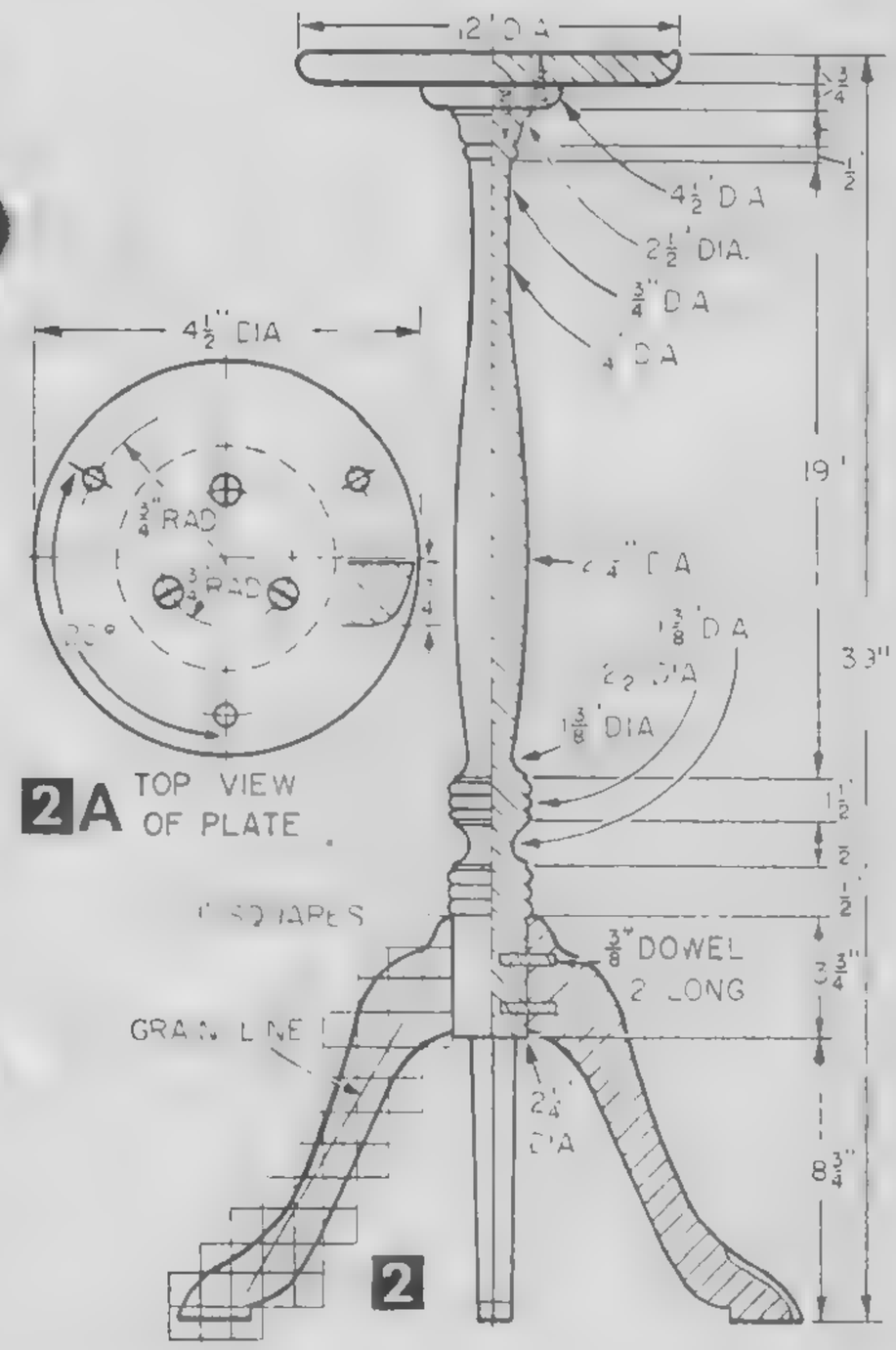
Amt. Req.	Size and Description	Use
1	3/16 x 4 1/2 x 7" cold-rolled (c.r.) steel	base plate
1	7/16 x 7/16 x 1" c.r. steel	pressure block
1	3/8 dia. x 5 1/2" c.r. steel rod	spindle
1	3/4" dia. x 1/2" c.r. steel rod	collar
1	1/4" dia. x 4 1/2" c.r. steel rod	handle
1	1/8 x 2 x 2 13/16" c.r. steel	head plate
2	1/16 x 3/4 x 6 1/4" soft strip steel	sliding support
4	nominal 3/8" steel pipe, 7/8" long	worktable spacers
2	3/8" dia. x 1/2" c.r. steel rod	support spacers
4	1/8 x 1 x 5 1/2" angle iron	cross braces and table
2	nominal 1/2" x 6 3/4" long iron pipe	standards
1	.025 x 1/4 x 2 3/8" clock spring	clips
2	1/8" dia. x 1 1/16" drill rod pins	
2	1/16" dia. x 1/2" soft steel pins	
1	3/8"-16 steel hex nut	
4	1/4"–20 x 1 1/2" flat head screws with nuts	
4	1/4"–20 x 1 1/2" machine bolts with nuts	
4	8–32 x 3/8" round head machine screws with nuts	
4	6–32 x 3/4" round head machine screws with nuts	

trim it along the centerline of the 3/16-in. hole. The purpose of these clips is to carry the sliding support when the spindle is raised. When tightening, the pressure is on the ball end of the spindle in its seat. Lubricate the spindle tip with a small amount of grease when assembling.

Clean the press with a grease solvent and paint all of it except the standards with a coat of enamel. Cut a hole in your bench top to match the clearance hole in the base and mount the press directly over it with flathead woodscrews.

Keep an assortment of steel flats and rods near the press to use as supports when pressing bushings or shafts in and out of work (Fig. 5). Figure 5 also shows setups for punching and forming operations.

Maple Candlestand



ITS unusual height and slenderness make this a real Colonial conversation piece. Your wife can use it to bring new color to a dark corner with a vase of flowers. Or you can tote it, complete with ashtray, to any spot where you might choose to have a quiet smoke.

The legs are adapted from the familiar Chippendale S-curve which cabinet-makers call an *ogee*, and architects call a *cyma reversa*.

Turn the post on the lathe from 2 1/2-in. dia. stock, 28 3/4-in. long. Turn the plate, with its curved lower edge out of 3/4-in. stock, 4 1/2-in. diameter. Drill six holes clear through the plate, making them 120° apart on two different radii (Fig. 2A). Countersink the three holes on the 1 3/4 in. radius from the bottom side. Countersink the three on the 3/4-in. radius on the upper side.

Turn the 12-in. diameter disc for the top on a face plate. Note its V-groove on the top side. Carefully sand and finish the turned top, plate and post while on the lathe. Make the next-to-last final sanding with a very fine paper and a light touch that travels up and down the piece rather rapidly to prevent deep scratches. Make final sanding grainwise, with lathe stopped.

Apply a heavy coat of maple oil stain, allowing it to stand until it becomes fairly stiff and semi-dry. Then, with the piece turning in the lathe, hold a pad of toweling or soft carpeting firmly against it, moving back and forth until all excess stain is removed and a deep, soft glow appears upon the wood. Coat with paste wax for protection.

Cut the Legs to pattern in Fig. 2. They may be tapered from 1 1/4 in. at the top to 1 in. at the bottom, or left with parallel sides about 1 1/8 in. thick. Note the legs decorative groove, cut with a shaper near the base. Concave the legs' upper contact surfaces to fit against the post, by holding the leg against a sanding drum of the same diameter as the post. Drill the dowel holes (Fig. 2) and assemble legs and post with glue and two scored 3/8-in. dowel pins to each leg.

Screw the plate to the top of the post. Then turn the table upside down on the top piece and run three screws through the plate into the top to complete assembly.—N. ENGELS

How to Build and Use a PORTABLE SMOKEHOUSE

Upper compartment trays are well spaced and clear sides by 2 in. for high smoking efficiency. Two-burner electric stove below is heat source used to create smoke from sawdust or wood chips in pan directly over it.

THE compact portable smokehouse in Fig. 1 can be built with ordinary household tools over a relaxed weekend.

It is essentially a tight plywood box with the lower half lined with sheet metal and the upper portion equipped with smoking trays. Spring tension on doors and weather-stripping around openings keep the box tight enough to control temperature and smoke circulation.

Be sure to use exterior grade plywood throughout—this type will not delaminate under exposure to severe extremes in heat and moisture, except for unusual circumstances. The smoker will blacken quickly, so used or scrap lumber will do as well as new wood for the simple framing of 1 x 4s and 1 x 2s. But, even using new lumber and hardware throughout, the cost should run between $20 and $25 for everything except the heat source.

Constructing the Cabinet. Begin by cutting the sides and back out of a 4 x 8-ft. plywood panel (Fig. 2). Cut the side cleats out of 1 x 2s (nominal size for a stock actually measuring ¾ x 1⅝ in.). Rip a piece of this stock in half for drip tray cleats.

Place the cut panels on sawhorses or a workbench and line the bottom two feet of each on the inside with a thin sheet metal, such as #26 gage. Use ⅜-in. tacks after punching small starter holes with an awl. Rule off cleat location lines (Fig. 2A), then attach cleats as in Fig. 3A. Bottom tray and drip tray cleats will mount on the metal.

Turn sides over and attach side framing as in Fig. 3B. Fasten the back as in Fig. 3C and front framing pieces as in Fig. 3D, using 6*d* nails. Before securing the lower 1 x 4 member in front, line it with sheet metal.

Build up a 21¾ x 23¼-in. platform from wide shelving stock or use ½-in. or thicker plywood if you have this size handy. Line top side with the sheet metal. Enclose the bottom opening with this floor, aligned with bottom edge of the plywood sides. Fasten with nails through framing and plywood.

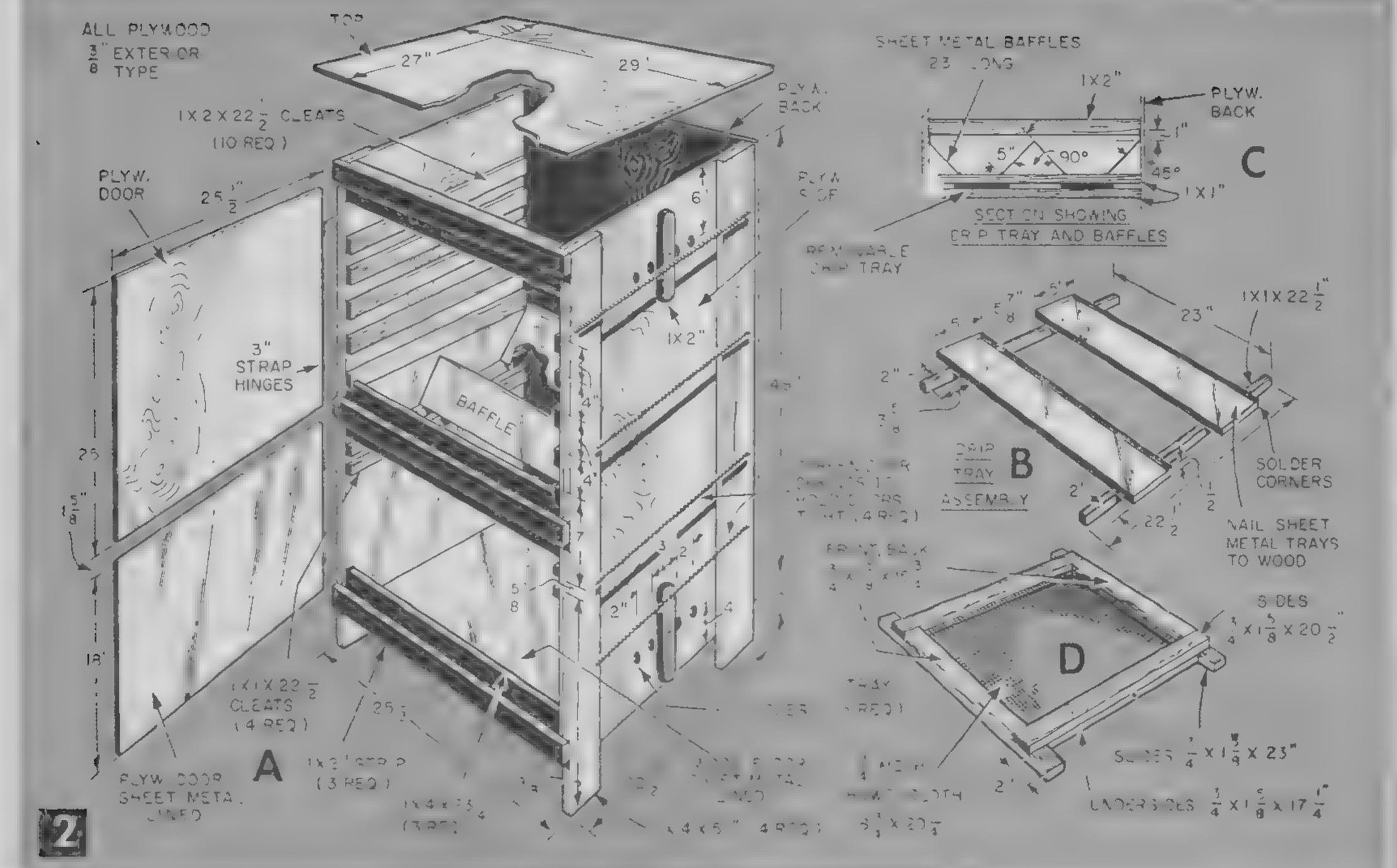
Add three 1 x 2 strips across the front as in Fig. 2A, nailing each to the side edges. Check distance between strips and modify dimensions if necessary, then cut the two doors as in Fig. 2A from the remainder of the 4 x 8-ft. panel. Tack a sheet metal lining on lower door. Hang doors with 3-in. strap hinges.

Form the drip trays from sheet metal as in Fig. 2B, allowing ½ in. for sides. Attach to wood strips made by ripping a 1 x 2 in half. Solder corner joints and around nail heads to prevent leaks. Drippings could start a fire.

Buffer Plates or Baffles guide smoke and divert drippings. Shape as in Fig. 2C, bending upper edges on front and back baffles about 45°. Rest baffles on top drip tray cleat so that bent edges parallel front framing piece and rear plywood. Tack in place. Center right-angled baffle and hold in place with a tack at each contact point on cleats. With drip trays in position, all open area between baffles should be over them.

Form the five upper compartment trays with hardware cloth nailed between two plies of 1 x 2 stock as in Fig. 2D.

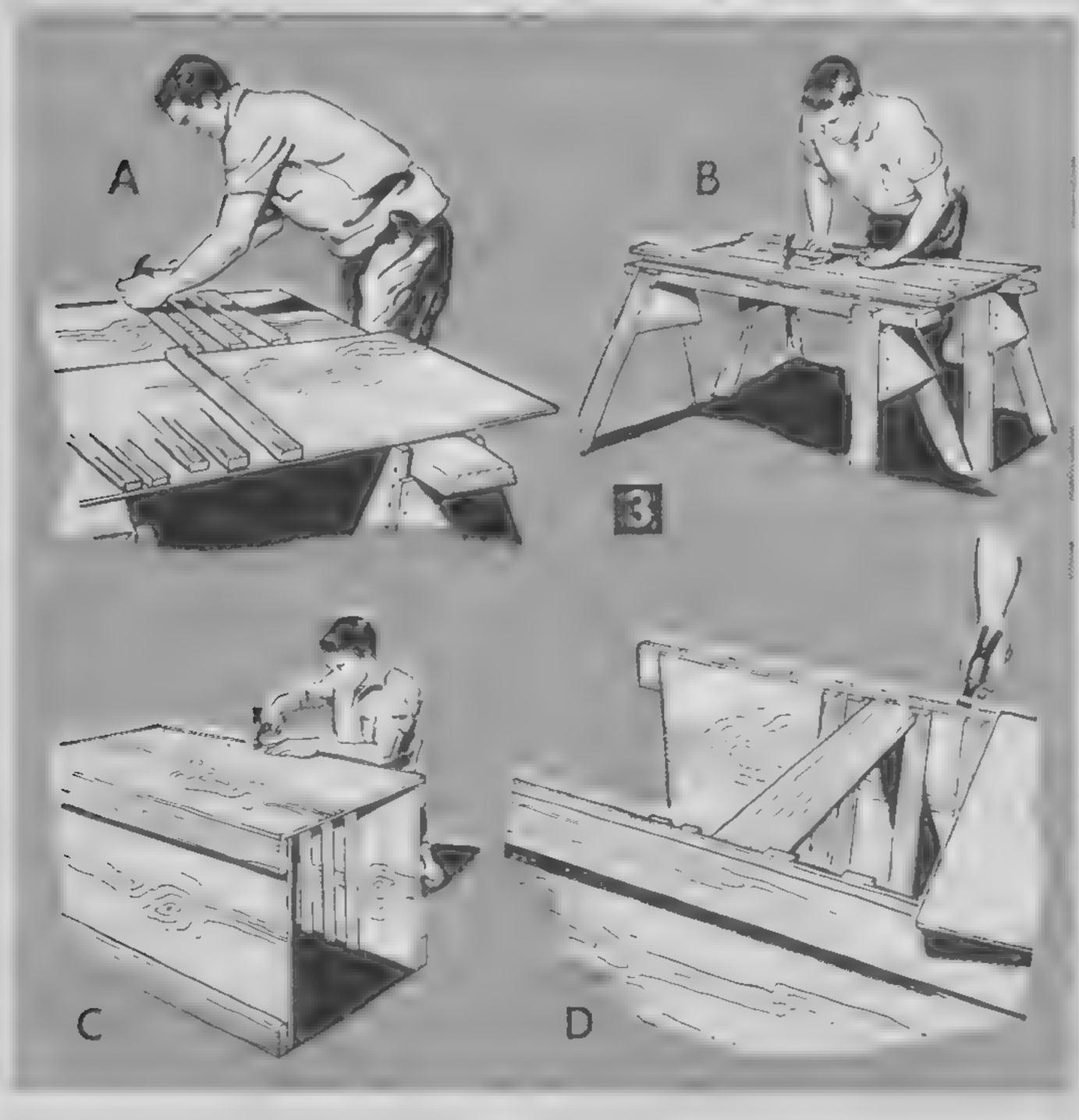
To insulate door openings, install weather-stripping around the framing as in Fig. 2A. Drive a 4*d* nail opposite each hinge and into the open edge of each door, leaving about ½ in. of nail exposed. Staple or hook ends of screen door springs to the rear side framing opposite the exposed nail heads as in Fig. 4. Doors seal shut when you hook free ends of



springs on the nails.

Drill 1-in. vent holes near the top and bottom of both sides as shown in Figs. 2A and 4. Shape adjustable caps from 1 x 2-in. stock to cover holes and install with a center screw or bolt as in Fig. 4. Center and nail a 27 x 29-in. piece of exterior plywood over the framework.

Once you add a heat source such as the twin hot plate in Fig. 1 and place a rimmed baking tin of about the same length on top, your smoker is ready for operation. Drill a small hole through lower back panel to admit the line cord plug. Always connect this to an extension cord *outside* of the cabinet.



The Process of Smoking not only adds to the flavor of fish, meat and fowl, particularly game varieties, but eliminates a need for refrigeration during the preserving time.

To create smoke, partially fill the pan with sawdust or small chips of hardwood, or non resinous softwood. Turn burner to medium heat first, then experiment

(A) Locate cleats and "tack" in place with 1-in. nails. (B) Flip over the panels, align 51-in. 1 x 4s with top and side edges and nail through to cleats with 1¾-in. nails. (C) Attach back panel to sides, again aligning top and side edges. (D) Stiffen assembly with front framing pieces. Note that crosspiece in the middle is notched to locate it 19⅝ in. from bottom edge.

for right temperature. This depends on construction, type of sawdust, voltage, altitude and outside temperature. The filling will last about six to eight hours.

A thermometer will help you maintain temperature. For a simple installation, drill a 1-in. dia. hole near the smoker top, insert a thermos cork and push an oven thermometer through the cork.

Control ventilation carefully so that the wood smoulders and smokes, but does not flame. If fuel flares up, reduce heat and place a metal sheet over the pan until the flame subsides.

Hot-Smoked or Kippered Meats are completely cooked with smoke, but because they are not fully dried, their keeping qualities are limited. Unless canned, refrigerated or frozen, they should be eaten within a few days after processing.

Cut meat into convenient sizes and immerse in a brine of 9 to 15 oz. of salt per gallon of water for 12 to 24 hours. Average tastes will find 11 oz. of salt per gallon and 16 hours' brining time about right. Next, soak two to four hours in *fresh,* not running, water. Flavoring can be added. Drain well and dry with cloth or paper towel.

Let meat surface dry (*very important*), place on trays and put in smoker. Apply warm smoke, around 100°, for four to six hours and finish with hot smoke, about 150°, for another hour or until fully cooked. The longer the smoking, the drier the meat.

Cool-Smoked Meats or Fish are not cooked but are completely dried and will keep almost indefinitely, *if* kept dry. Immerse in brine as for hot smoking, but *do not freshen* with clear water. Drain and dry thoroughly, then place in smoker. Smoke at temperature not exceeding 90° until sufficiently dried—usually 3 to 5 days. Smoking need not be continued day and night, but should be completed as soon as possible, particularly in warm weather.

For jerky (meat cured by cutting into strips and drying, such as dried beef), smoke is desirable but not mandatory. You may leave venison and other game meats in the smoker under heat alone until completely dry. To prevent cooking, temperature should not exceed 150°.

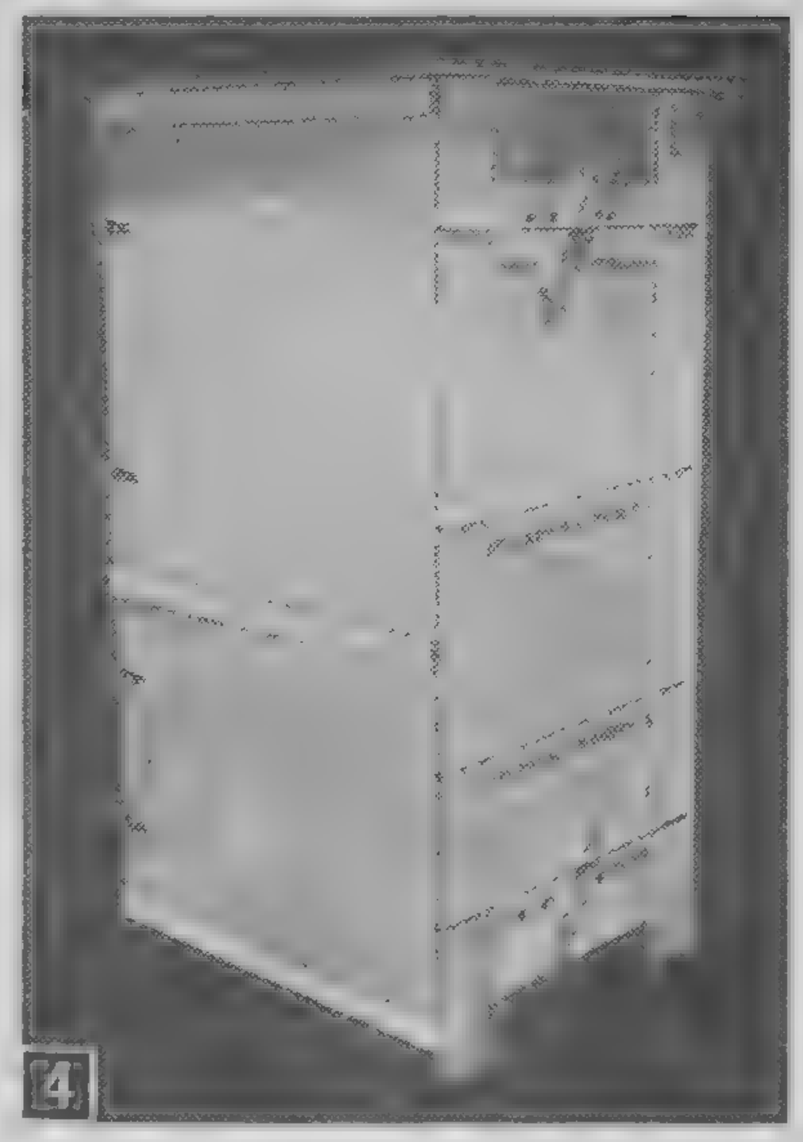
Onion, garlic, pepper, tabasco and other flavorings may be added to brine mixtures to suit. Some people find that basting with cooking oils improves flavor of fish with a low oil content, such as flounder.

Smoking Fowl, Game Birds. Pack cleaned and drawn birds close together in a crock, odorless hardwood barrel, enamel or porcelain tub. Cover with a curing solution of 6 lbs. salt, 3 lbs. sugar, 3 oz. of saltpeter dissolved in 4½ gals. of water. Weight birds to prevent floating.

Remove birds once weekly, then repack to be sure solution contacts all parts of the birds. A fresh solution is not necessary but hold temperature near 38°. If you need to use ice, don't let it melt into container.

Meat should be cured and ready to smoke in two to four weeks, depending on weight. A turkey, for instance, should stay in brine 1½ days per pound of dressed weight. Wash, hang to dry and then smoke the cured bird, using hardwood at smokehouse temperature of 100 to 110°. A few hours' smoking may give the desired flavor or you might wish to smoke several hours daily for several days.

Caution. This portable smokehouse is fire-resistant, not fireproof. Don't set it next to another building while in use and take care not to overheat. Since it may be heating continuously for long periods, it's a good idea to ground the hot plate to a nearby pipe and avoid a possible short-circuit. Careful regulation of the air vents and burner controls is your best insurance against losing the smokehouse and—even more important—that tenderly prepared game fish and meat.—FRANK C. BEESON.



Long screen door springs hook onto nails protruding from door edges to hold doors tightly against weatherstrip seal. Vent holes at top and bottom of each side help control ventilation and temperature.

MATERIALS LIST—PORTABLE SMOKEHOUSE

No. Req'd.	Size and Description
1 pc	3/8" x 4 x 8' exterior grade fir plywood (back sides, doors)
1 pc	3/8 x 27 x 29" exterior grade fir plywood (top)
1 pc	3/4 x 7½" x 6' (nominal 1 x 8) fir or pine (floor)
2 pcs	3/4 x 3⅝" x 9' (nom. 1 x 4s) fir or pine (side framing)
1 pc	3/4 x 3⅝" x 6' (nom. 1 x 4) fir or pine (front framing)
10 pcs	3/4 x 1⅝" x 10' (nom. 1 x 2s) fir or pine (side cleats, trays, drip tray ties, vent hole caps)
12 ft	#26 gage x 24" wide sheet metal (baffles, drip trays, lining)
8 ft	¼"-mesh x 24" galvanized hardware cloth (trays)
4	16" spiral door springs (door tension)
16 ft	½" cushion weatherstripping (door insulation)
2 prs	3" strap hinges (doors)
1	2-burner, 3-speed electric stove up to 19" wide
1	large rimmed baking sheet (fuel holder)
Misc.	3 screw hooks or staples (springs), box 3/8" tacks, 4*d* and 6*d* common nails, 1" lath nails, 4 1½" *fh* (flathead) machine screws and nuts

Black

Ultra-violet radiation, called "black light" because it is invisible (and so is therefore not really light at all), is the energy source of this printing outfit, which makes blueprinting and whiteprinting possible for the home workshopper.

Make permanent blueprints of your drawings for less than 2¢ per square foot with invisible ultra-violet radiation

By S. S. MINER

NO TRICKY chemicals or darkroom techniques are required to use this versatile printing outfit that you can build for less than $20.00. The smallest commercially available blueprinters cost from $180.00 up.

With inexpensive common household bleaches you can make either the standard blue-background prints, or the newer white-background prints, in blue-line, red-line, and other colors. You can work in a lighted room, and within minutes have up to 12 x 20-in. reproductions of your drawings.

Ultra-violet light in the near-visible portion of the spectrum does the trick, activating any of the common blueprint papers. Harmful actinic rays are screened out, so you need no special protection. Blueprint and whiteprint papers are available at drafting room supply stores.

Start Construction of your blueprinting outfit by making the frame (Fig. 4). Use a straight-grained wood such as white pine or cedar (see Materials List) to minimize the chance of warpage, and get it in one length about 8 feet long to make shaping of the cross-section easier. If you do not have a table saw or rabbetting plane, get the glass rabbet (Figs. 2 and 4) cut in at the lumber yard. Form the rounded corner with a jack plane, wood rasp, and sandpaper. After shaping the cross-section of this strip, cut the four frame pieces to the required lengths (Fig. 4), and miter their ends at exactly 45°. Then join the frame with the four corner braces, checking the assembly to get opposite rails parallel and the corners precisely 90°. File the mitered ends of the rails, if necessary, to accomplish this. Also cut in the ventilating notches in the two end rails at this time (Fig. 4). Then disassemble the frame, apply waterproof glue to the mitered ends, and reassemble. Be sure the frame is still true, then set it aside until the glue sets.

Make four corner splines (Fig. 4, detail) out of ⅛-in. *Masonite.* When the glue is hard in the frame corners, lay out the ⅛-in. spline slots, and cut them in slightly undersize with a hack saw and coping saw. Then file the slots to receive the ⅛-in. thick splines snugly, apply waterproof glue to the splines and slots and tap the splines into position. After the glue has set, smooth up the frame with fine sandpaper and apply three coats of clear shellac, sanding with fine steel wool and dusting between coats.

To get a good fit on the glass, take the frame to the hardware store and have them fit the glass to it, Get double-strength window glass. Then carefully chamfer all the glass edges with an oil stone, used dry, holding the glass on the lap while rubbing the stone back and forth along the edges.

Make the Two Print Holddowns (Fig. 6) out of 12 x 14-in. pieces of ⅜-in. thick *Novoply,* or similar glued-wood-chip material. This material, available at lumber yards, will usually warp less than plywood, and for this application flatness is essential. Fasten a 4-in. sash lift in the center of each holddown, and cover their lower surfaces with a cotton fleece

ck Light Blueprinter for Your Workshop

material, cemented with a plastic cement around the holddown edges. One small baby blanket provided enough material for the two holddowns shown. The purpose of this padded construction is to insure complete surface contact between the tracing and print papers during exposure. If good contact is not had, fuzzy lines will result.

Lay out the sheet metal ends and sides (Fig. 5), and cut them out with tin snips. Twenty-size gage galvanized is specified for economy's sake, but you can use aluminum if you prefer. Drill the attaching screw holes in their top edges approximately 3 in. apart, but do not drill the other holes in the panels at this time.

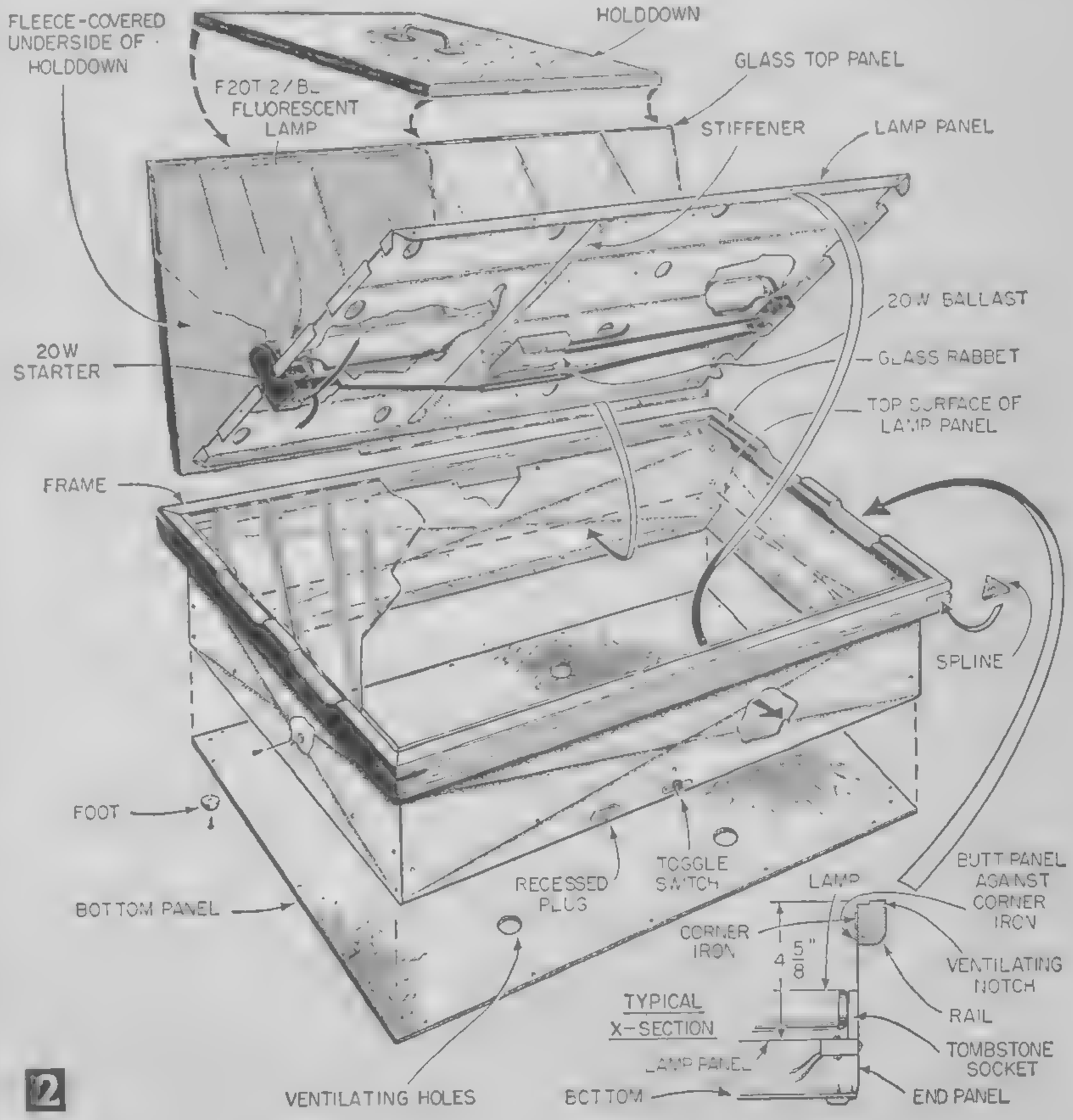
As these panels are quite thin, they should be stiffened by "break lines" crossing them diagonally. These are actually very low ridges formed by bending the sheets about 10° along the indicated lines, then flattening them again.

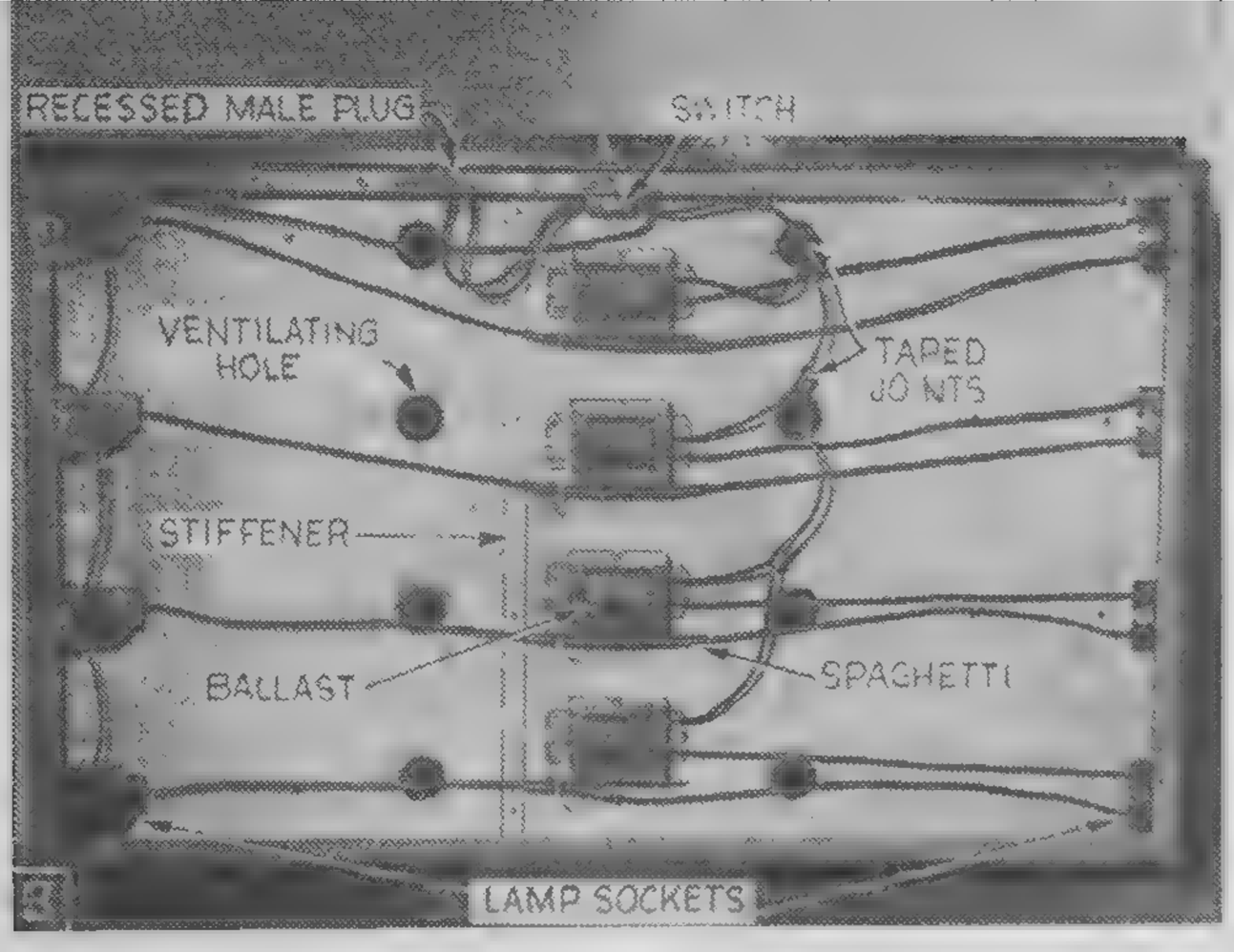
Bend the end and bottom flaps where indicated, 90° to the panels. Note that while the length of the side panels is given as 24 in., the same as the inside of the frame, the dimensions should actually be slightly less than this, to allow for the thickness of the two end panels, and for the small radius, perhaps 1/32 in., which will occur at the bends. The bends must therefore be started about 1/32 in. short of the desired location. This bending can be done by clamping the panels between two sharp-edged planks, or two angle-irons, and pushing the flaps over with a short length of wood struck with a mallet.

After bending the flaps, mount the panels in the frame with #6 pan-head sheet metal screws, 3/4-in. long. Then clamp the corners with C-clamps, and lay out and drill the holes for the 8-32 x 1/4-in. *rh* screws (Fig 5), and put in these fastenings.

Make the Lamp Panel (Fig. 8) next. Before cutting the lamp socket notches, check the dimensions of the lamp sockets you have purchased, as these fixtures vary slightly in size. Cut the holes for the starters, and the ventilating holes, with tin snips or a 1-in. diameter hole cutter. Note that this panel has four longitudinal break lines for stiffening. Bend these in, then bend the edge flaps down, making allowance as before for the radius of these 90° bends and for the metal thickness, to make sure that the panel will go inside the box. Then clamp the panel in position in the box, drill the 8-32 screw holes, and fasten the panel in place.

If you have used galvanized sheet metal in making the box, prepare the outer surface of the box and the lamp chamber by etching with ordinary vinegar. Sponge the vinegar onto the metal and wait for it to evaporate off. Then paint the lamp chamber, two coats, with a good quality aluminum paint, to im-





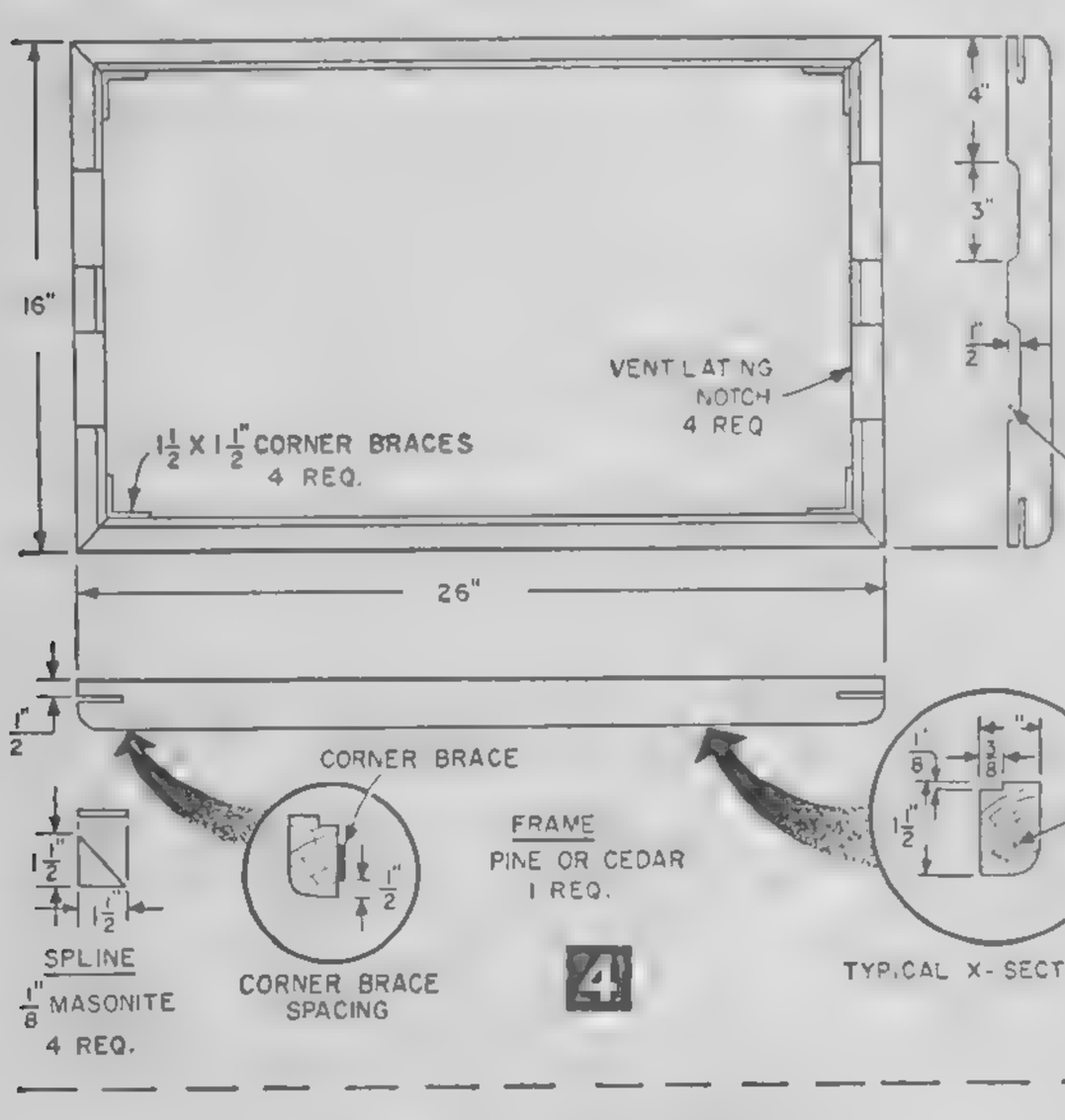
Underneath view of the printer, with bottom panel removed. All the electrical components, except the fluorescent bulbs, are beneath the lamp panel. Note how wires are protected with spaghetti where they pass the ballasts.

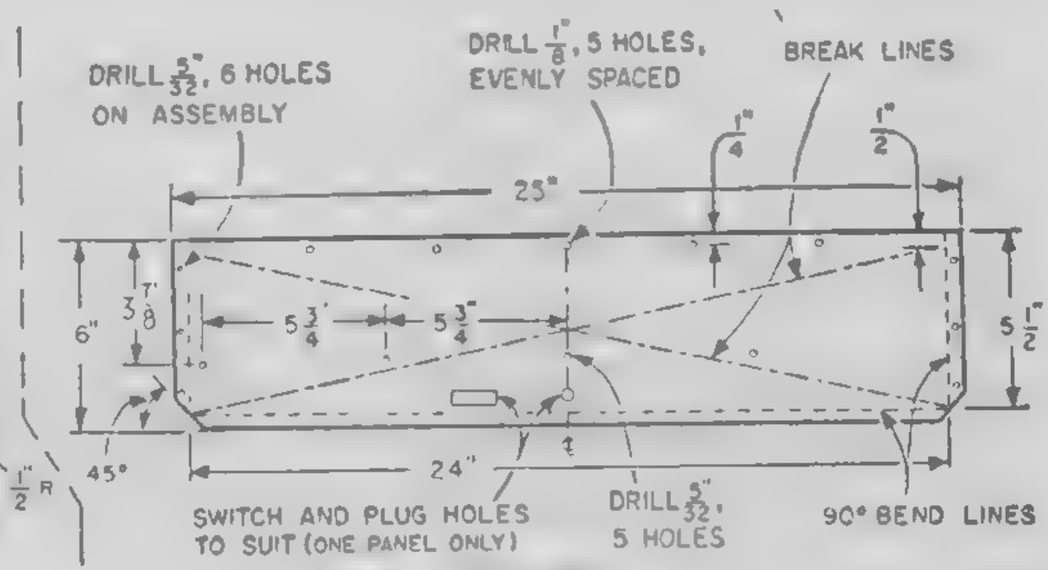
prove its ultra-violet reflecting properties (or line it with aluminum foil adhered with plastic cement). Paint the outside of the box with a machine enamel.

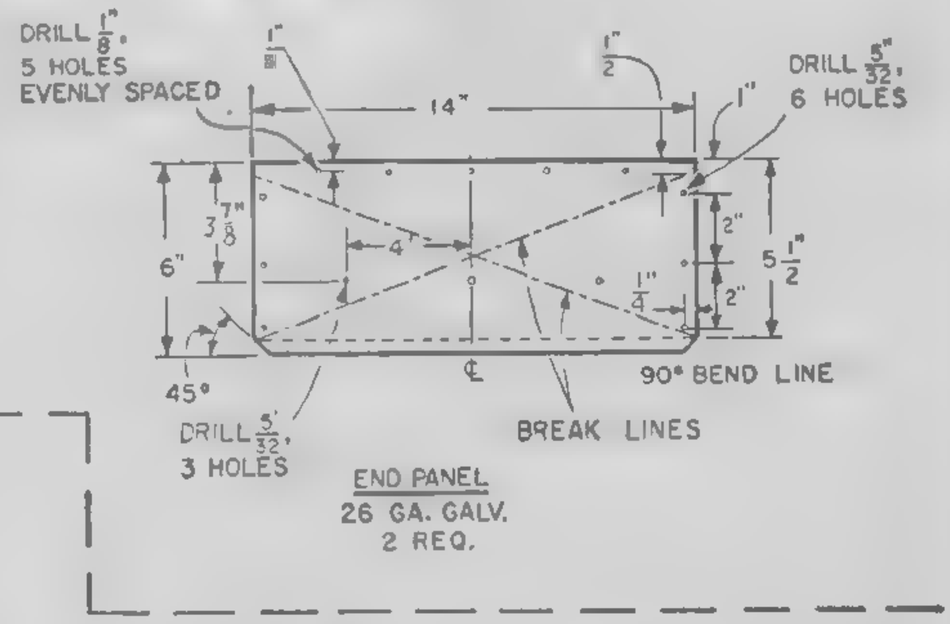
Make a crossbrace (Fig. 8) to support the weight of the fluorescent lamps by bending a 2-in. wide strip of sheet metal to Z form, and then collapsing it nearly flat, leaving the bends round for maximum stiffness. Fasten this stiffener in place on the underside of the panel with four #6 pan-head sheet-metal screws. Mount the ballasts with their lead wires pointing away from the starters (Fig. 9). Slip the lamp sockets into their notches, and secure them temporarily.

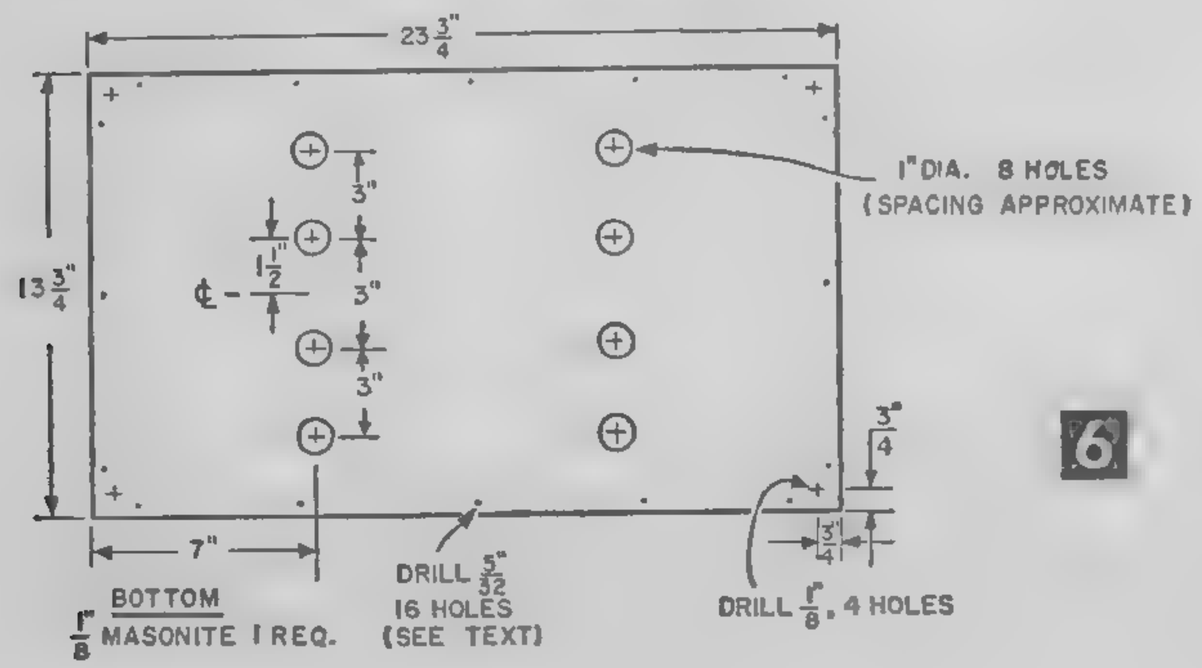
Wire Your Blueprinter with #16 stranded fixture wire. Locate the toggle switch and the input plug (a recessed male plug of the type used on TV sets) on one of the side panels (Fig. 2). Solder all wiring connections, except those at screw terminals, and tape the soldered joints with plastic electrician's tape.

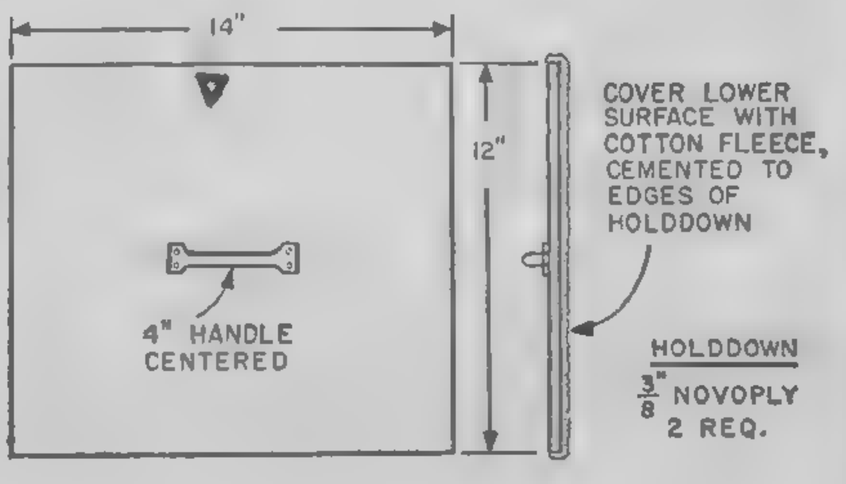
Make the bottom panel of ⅛-in. Masonite (Fig. 6) cutting in vent holes as indicated. Attach it to the side and end panel flaps with #6 pan-head sheet metal screws spaced about 5 in. apart. Attach rubber feet to the bottom











panel corners with the same size sheet metal screws.

The whiteprint developing tube (Fig 11) is made of a 24-in. length of 4 in. diameter snap-lock aluminum air duct. Cut off the crimped end but leave the bead. Cut the other end of the tube to the correct length, leaving five tabs on the lower edge. Cut the 180° opening 2 in. up from the bottom edge, opposite the seam, and drill the sixteen 1/16-in. grid holes. Make the 4 in. diameter ammonia pan platform out of the cut-off end of the tube, and fasten it in position in the tube with four of the #6 sheet metal screws.

Cut a 3/8-in diameter hole in the front of the lower chamber of the tube for the nipple of an intermediate size lamp socket. Install the socket and a 7½ watt bulb, and wire it up with a 6 foot extension cord and switch.

Use a 6¼ in. diameter aluminum sauce pan lid for the base of the developing tube (Fig. 11). Just remove the lifting ring from it, and mount the tube centrally on it with five 8-32 *rh* (round head) screws 3/16 in. long (cut down from ¼ in. screws).

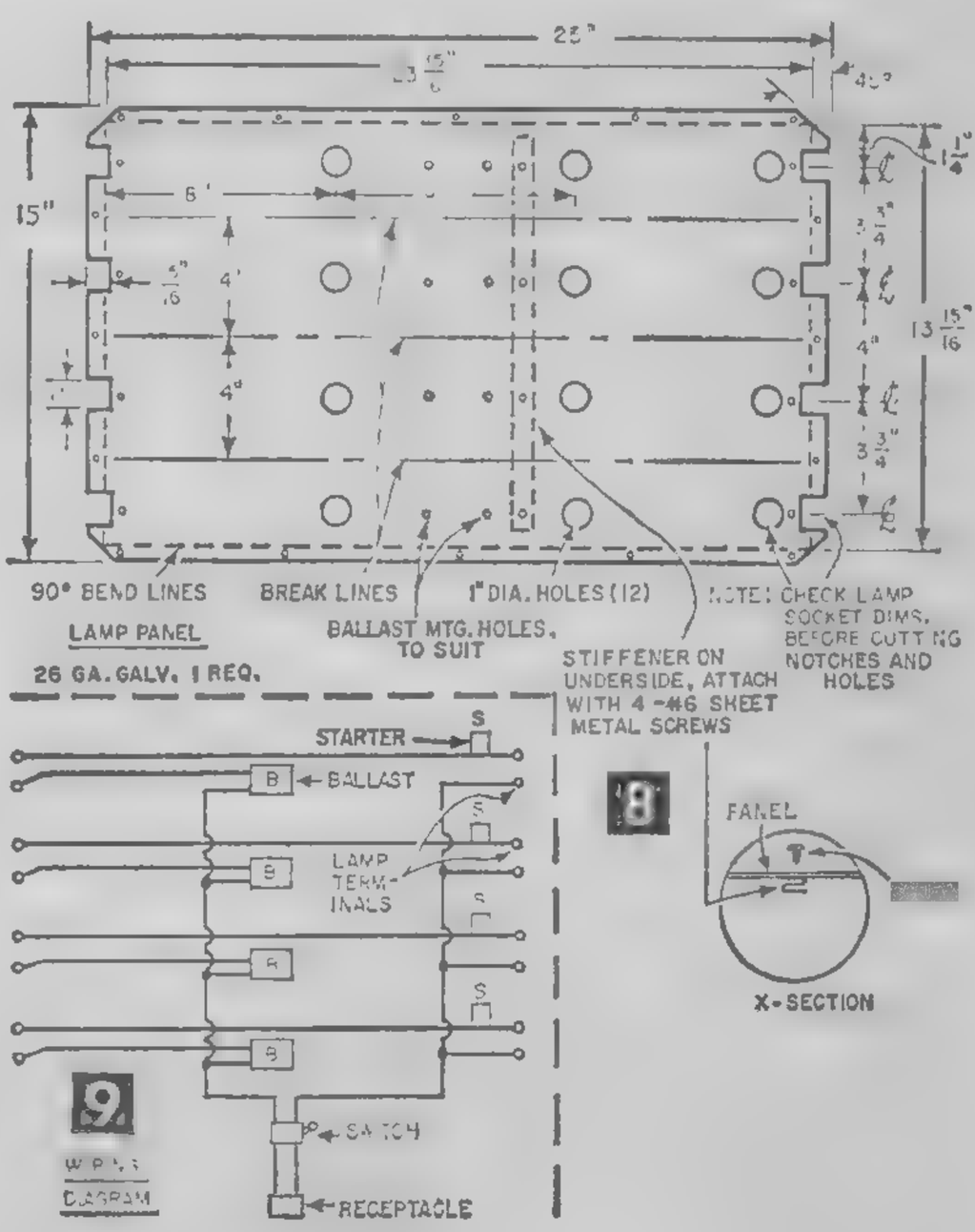
For the ammonia pan, trim a small sauce pan to slip into the tube opening. Provide a bent down tab or a small knob on the pan for easy handling. Make the developing tube lid

out of a 6¼ in. aluminum sauce pan lid cut to 4¾ in. diameter, and then formed down to fit over the beaded top edge of the tube (Fig. 11). To support drawings in the tube, make a wire grid by lacing a fine wire back and forth in a square pattern, through the 1/16 in. holes just above the pan opening (Fig. 11).

To Make A Blueprint, place your original tracing, right side down, on the glass top of the printing box, with a piece of blueprint paper, sensitized side down, on top of it. Then place a padded holddown on top of them (Fig. 1). Turn on the ultra-violet lamps, for 30 seconds to 2 minutes. Then turn the lights off, remove the exposed blueprint paper and wet it with water under a faucet (Fig. 12). Then wet the paper thoroughly in your developing tray (Fig. 7), which should contain a weak solution of a sodium hypochlorite bleach (such as *Clorox*) in water. One tablespoon of bleach to two cups of water is a good proportion to start with. After wetting the print, hold it up to permit the excess developing solution to run off. As you watch, the blue color of the background will deepen, and the

MATERIALS LIST—BLUEPRINTER

No. Req.	Size and Description	Use
1	1 x 1½" x 8' long, white pine or cedar	frame rails
1	1/8 x 14 x 24" Masonite	bottom panel
1	30 x 36" (approx.) 26 ga. galv. (or aluminum)	box
1	4" dia. x 24" long snap-lock aluminum air duct	developing tube
2	6¼" dia. aluminum sauce pan lids	developing tube
1	3¾" dia. sauce pan, muffin tin, or jelly mold	developing tube
6 ft.	tinned iron wire, approx. .010" to .015" dia.	developing tube
2	3/8 x 12 x 14" Novoply (or Partex)	holddowns
2	4" long metal sash lifts, with screws	holddowns
1	16 x 30" (approx.) cotton fleece	holddowns
4	1½ x 1½" corner braces, with screws	frame
1	1/8 x 1½ x3" Masonite	frame splines
1	double strength window glass, fitted to frame (approx. size, 14¾ x 24¾")	frame, contact glass
4	¾" dia. rubber feet	bottom
5 doz.	#6 pan-head sheet metal screws, ¾" long	fastenings
4 doz.	8/32 x ¼" *rh* (round head) screws and nuts	fastenings
NOTE:	The following electrical items can be obtained through any electrical supply firm, except the last two, which can be obtained from electronics dealers.	
4	F20T12/BL fluorescent lamps (about $1.60 [illegible]h)	
4	tombstone-type fluorescent lamp sockets, plain	
4	tombstone-type fluorescent lamp sockets, starter type	
4	fluorescent lamp starters, 20W. size	
4	fluorescent lamp ballasts, single-lamp 20W. size	
1	intermediate size lamp socket, 115V., without switch	
15 ft.	#16 stranded fixture wire	
1	intermediate size round lamp bulb, 115V., 7½W.	
1	cord switch, 115V., 6A.	
1	6 ft. extension cord, with plug	
1	DPST toggle switch, 115V., 6A.	
1	recessed male plug, 115V., 6A.	
1	television cheater cord	
Misc.	machine enamel, waterproof glue, plastic cement, aluminum paint or foil, electricians tape.	



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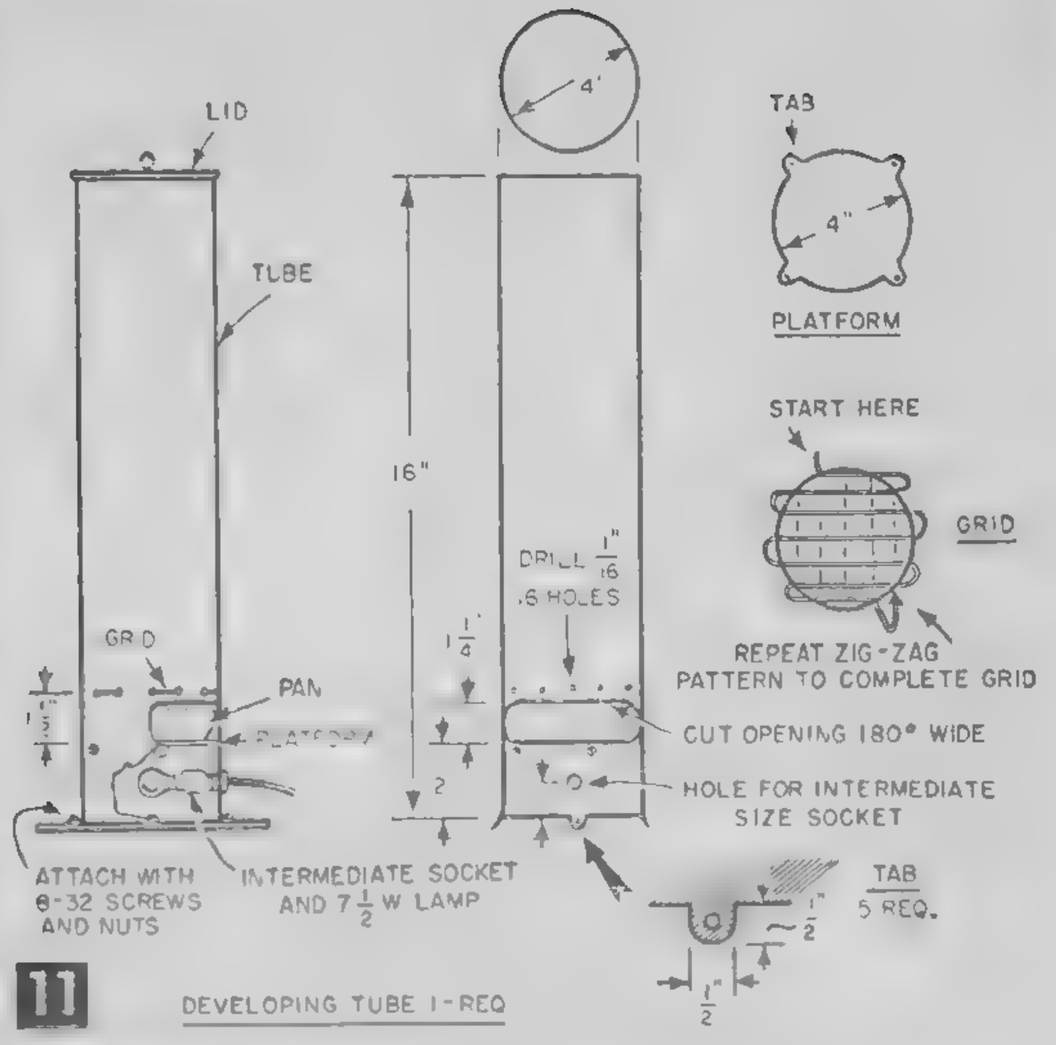
Exposed whiteprints are lowered into the developing tube. The ammonia can be warmed, if necessary, to promote vaporization.



11 DEVELOPING TUBE 1-REQ

12

Two rinses in plain water, one before and one after developing, are required for blueprints.

white lines of the drawing will stand out sharply. When full contrast is reached, rinse the drawing again under the faucet, let drip a moment, then blot it between several thicknesses of newspaper. Finally, lay the completed print out flat on newspaper, and leave it until dry.

Several trials may be required to determine correct exposure time, which will vary according to the speed of the blueprint paper you are using, the opacity of the lines of the drawings, the transparency (to ultra-violet radiation) of the drawing paper, the quality of the reflecting surface in the light box, and other factors. Experiment a little, too, with the concentration of the developing solution, until you get the proportions that give you the best results.

For Whiteprints, (blue line on white background), the exposure technique is similar to that used for blueprints, but the developing is done dry, in the developing tube. Fill the ammonia pan about half full of household ammonia, then slip the exposed print paper into the tube (Fig. 10) and cap the tube with the cover. In a few minutes, ammonia fumes rising up the tube will bring out the lines of the drawing, and bleach out the background. The drawing can be inspected from time to time to check progress. If too slow, turn on the heater—the small lamp bulb in the base. Experience will teach you the correct development time and temperature. In using the ammonia developing tube, good ventilation in the room is desirable, as the fumes are rather irritating to some people.

All blueprint and whiteprint paper should be stored in a light-tight envelope or container where it will be cool, dry, and free from alkali fumes such as ammonia. When cutting blue- or whiteprint paper to size from larger sheets, it is perfectly all right to work in a lighted place, provided you are away from windows and sources of near-violet radiation, such as fluorescent lamps, and provided you work quickly.

Other colors besides blue-line are possible. Some print paper companies manufacture papers which will produce red, black, yellow, green, or brown-line drawings on white backgrounds, all of which can be developed by the ammonia process. In addition, white-line prints on brown background, and certain other types, can be made, but require special developers. For home workshop use, the well-known blueprints and whiteprints are most practical, and are easiest to produce.


A

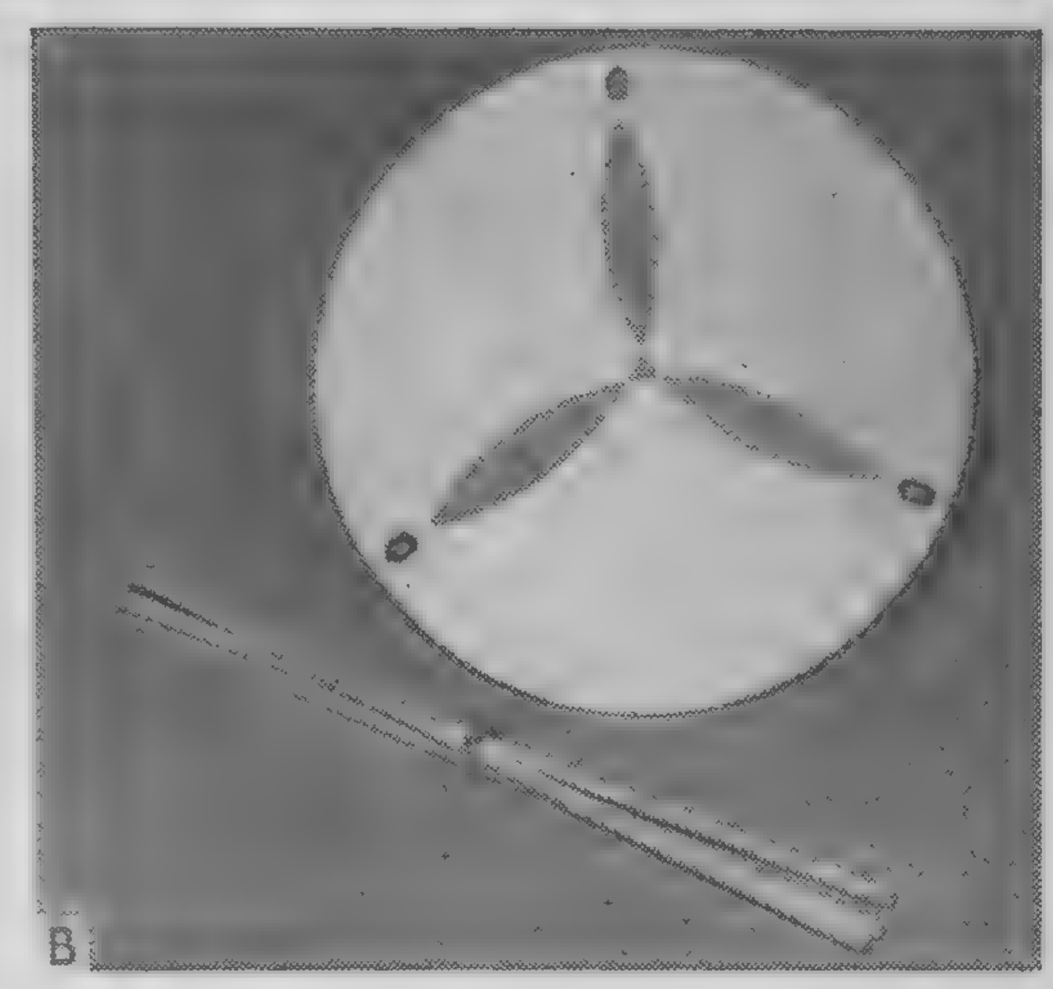
For less than $3, you can build this decorative serving table. The legs detach in a second, and fold up for easy storage.

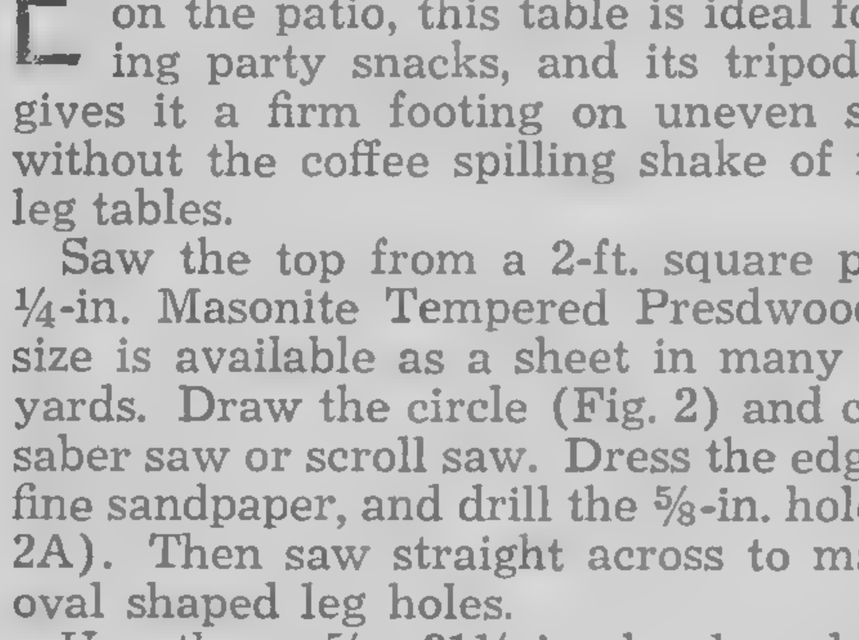
Snack Table

EQUALLY at home in your living room or on the patio, this table is ideal for serving party snacks, and its tripod design gives it a firm footing on uneven surfaces without the coffee spilling shake of most 4-leg tables.

Saw the top from a 2-ft. square panel of ¼-in. Masonite Tempered Presdwood. This size is available as a sheet in many lumber yards. Draw the circle (Fig. 2) and cut with saber saw or scroll saw. Dress the edges with fine sandpaper, and drill the ⅝-in. holes (Fig. 2A). Then saw straight across to make the oval shaped leg holes.

Use three ⅝ x 31½-in. hardwood dowels


B

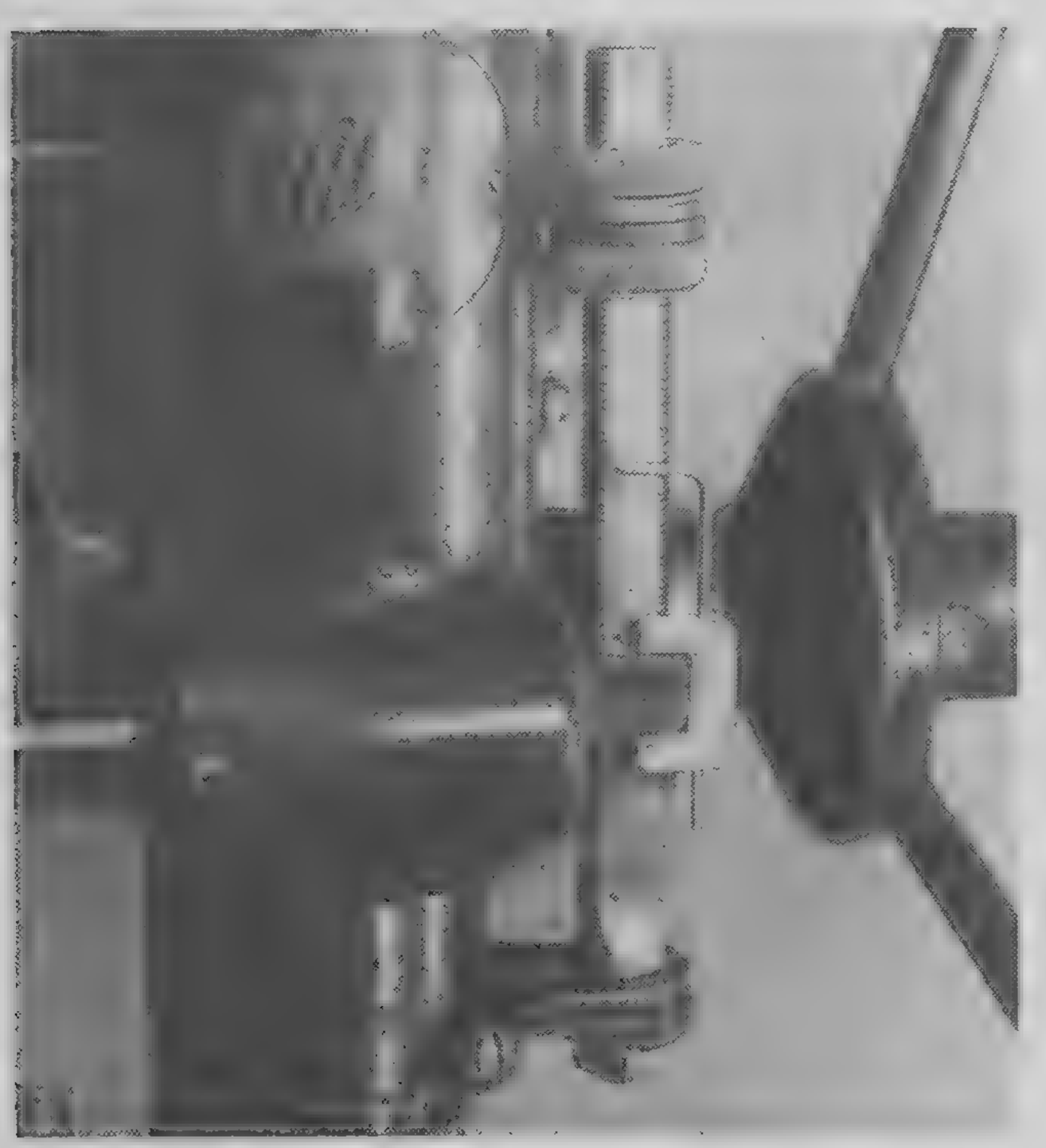


2

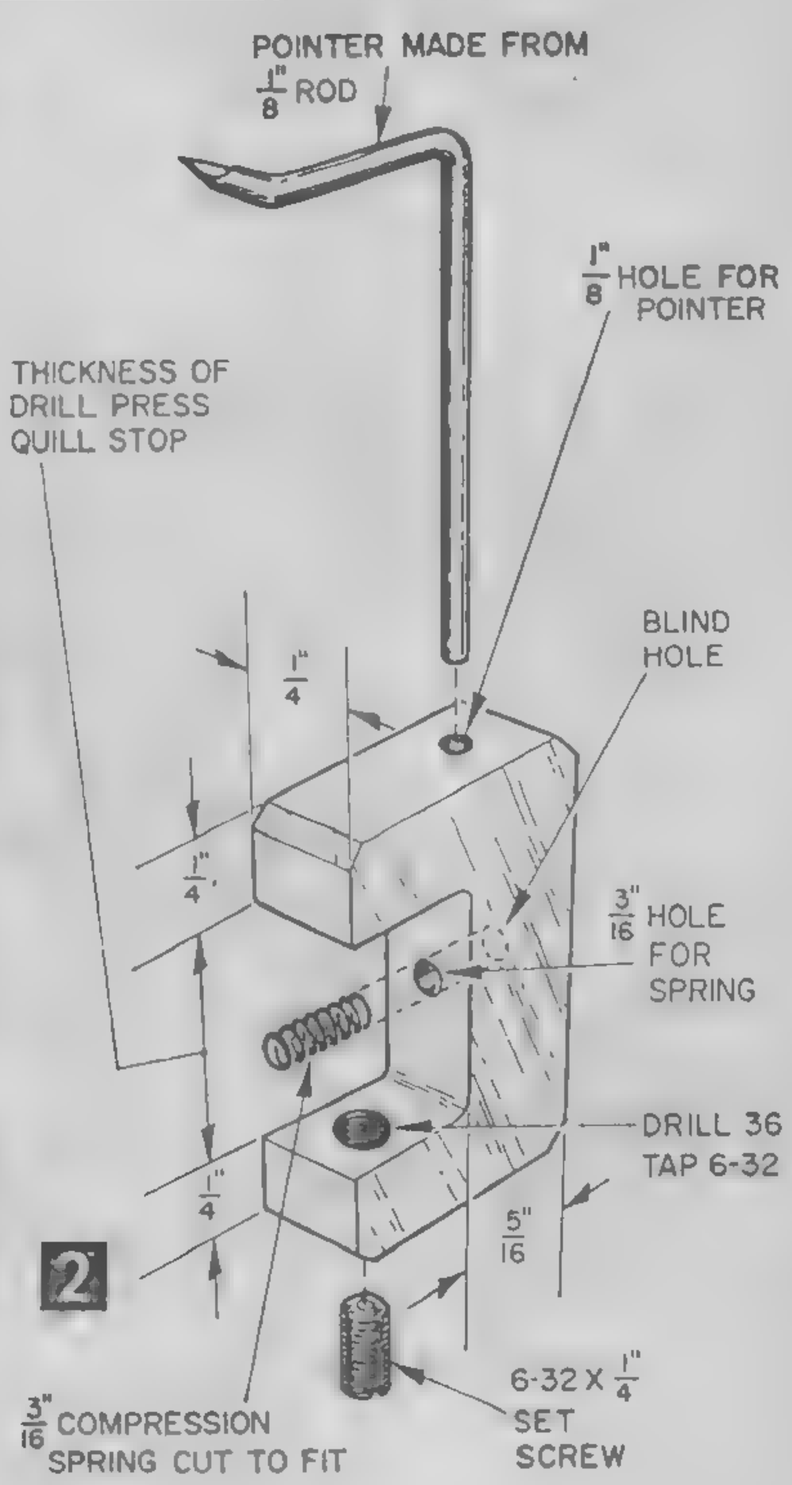
for the legs. Sand the ends round. Make the leg collar by hacksawing a ⅜-in. wide ring from a 1¼-in. I.D. piece of scrap pipe or tubing. Drill three equally spaced 5/32-in. holes through the collar for the #6 x ¾ in. *rh* wood screws that hold the legs. Then drill 3/32-in. pilot holes in each leg, 15 in. from the end.

To assemble, fit the legs through the collar, and partially tighten the screws. Spread the legs and place the table on top. After checking to make sure it's properly leveled, mark each leg and notch as in Fig. 2B.

Be sure to paint or varnish both sides of the table top the same way; a coat on one side can cause warpage. As an unusual effect, you could attach a circle-shaped photo enlargement with rubber cement, and then cover with a spray coat of clear plastic, or varnish. But again, remember to treat both sides of the table equally.—FRANK L. BRUNCKHORST.



You can set the pointer for depth readings in a second, and it swings out of the way when you're using the regular stop nuts.



Add this Fast-Set Depth Gage to Your Drill Press

INSTEAD of fumbling with locknuts, you can set this gage instantly while you touch your drill to the work, and it gives you an accurate depth reading while you drill.

Intended as a timesaver for modelmakers and woodworkers who often drill single hole jobs, the indicator flips out of the way when you want to use the regular depth lock nuts for repeat work. There's no chance of error in subtracting odd fractions on a dial. You simply set the pointer to any convenient even inch mark, and read depth in fractions as the drill penetrates the work.

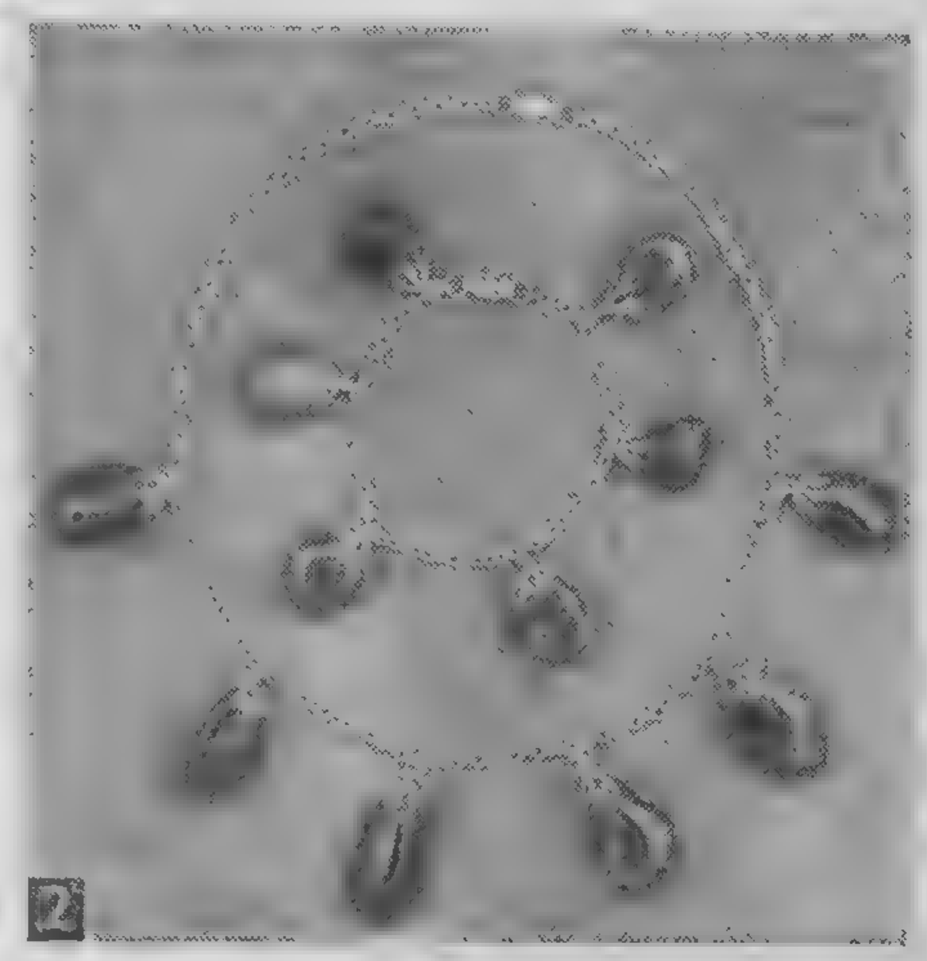
Shape the gage bracket (Fig. 2) of steel, or use softer brass or aluminum for easy working. You may need to alter dimensions to fit the casting on your drill press. Tap the hole for the set screw which clamps the bracket to the drill press. Bend the pointer from a ⅛-in. rod and grind the tip down to make a knife edge pointer. Fit a spring in the blind hole cross drilled in the bracket. This spring exerts pressure on the rod holding it in place, while the rod keeps the spring in position.—R. HANSCOM.

Gemstone Tumbler

Let this 6-barrel machine make beautifully polished baroque gems from the minerals and stones you collect. It does it while you sleep

By MALCOLM G. OWENS

1



2

Wristlet and necklace made from highly polished stones tumbled with the machine shown at left.

Tumbling barrels are arranged in two decks of three barrels each under bench. Top of bench is used for loading barrels.

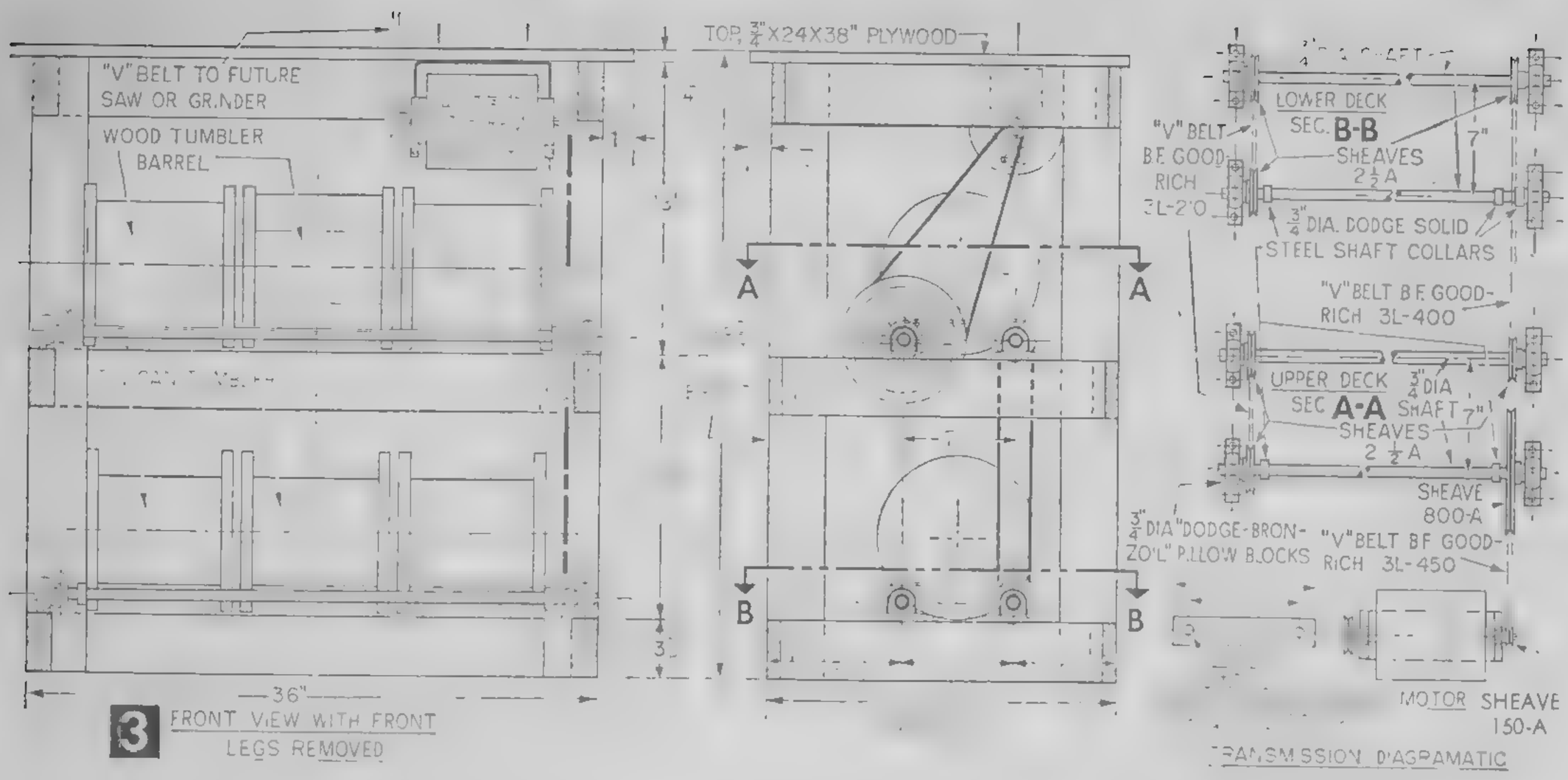
THE advantage this tumbling machine has over the large commercially-built tumbler is that amateur rockhounds can polish small batches of 8 or 10 pounds of stones through all progressive steps at the same time. No more waiting until you have an accumulation of 20 to 100 pounds of stones to turn out an efficient single-stage grind.

When used on a production basis, our tumbler is capable of turning out a steady flow of gallons of highly polished baroque gems (Fig. 2) with little effort on the part of the operator. In fact, once the tumbling barrels are loaded the machine will operate continuously night and day without attendance on your part.

We will cover the how-to of gemstone tumbling later in this article. Right now, let's get started with the construction of the machine.

Making the Tumbler Frame. Stock size 2 by 4- and 4 by 4-in. lumber was used for the frame to provide a heavy enough frame to dampen vibration and thus make a quiet-running machine. First saw the front, rear and end members to size as in Fig. 4 and half lap the ends for joining to the legs. Also drill the ends for wood screws. Then saw the legs to size and, when laying out the joint cutouts, check the width dimensions of the 2 by 4-in. members so that you will get snug fitting joints. Assemble the frame parts as in Fig. 3, fastening with glue and #10 x 1½-in. *fh* screws. Make the frame top from ¾-in. plywood but do not fasten it to the frame until after the barrel drive unit is installed.

Assembling Barrel Drive. The six tumbling barrels are arranged in two decks or layers of three barrels each. If three tumbling barrels will serve your present needs only the upper deck and drive need be installed at this



3 FRONT VIEW WITH FRONT LEGS REMOVED

TRANSMISSION DIAGRAMATIC

time, and you can save yourself the cost and time of making the lower deck assembly. The Materials List gives the parts required for either single or double deck installation. All of the drive parts are purchased items so the job is one of assembly rather than making anything.

The only critical step in the assembly is that of making certain the two ¾-in. shafts in each deck are level and absolutely parallel with one another. To do this, make up two shaft spacing guides as in Fig. 3. Clamp or temporarily nail the two guides together and drill the ¾-in. holes through both pieces at one time, so the 7-in. hole spacing will be identical in both guides. Then slide the guides and pillow block bearings on two of the ¾-in. shafts, and place the assembly on the upper-deck end members of the frame as in Fig. 3. Position the center of the front shaft 8½ in. from the front member and mark location of pillow block mounting holes. Drill 5/32-in. pilot holes and fasten pillow blocks with ¼ x 1½-in. lag screws.

Follow the same procedure when installing the lower deck shaft assembly. Then assemble the pulleys, belts and shaft collars on both decks as in sec. A-A and B-B of Fig. 3. The motor is bolted to the underside of the frame top which can be installed at this time with #10 x 1½-in. *fh* screws.

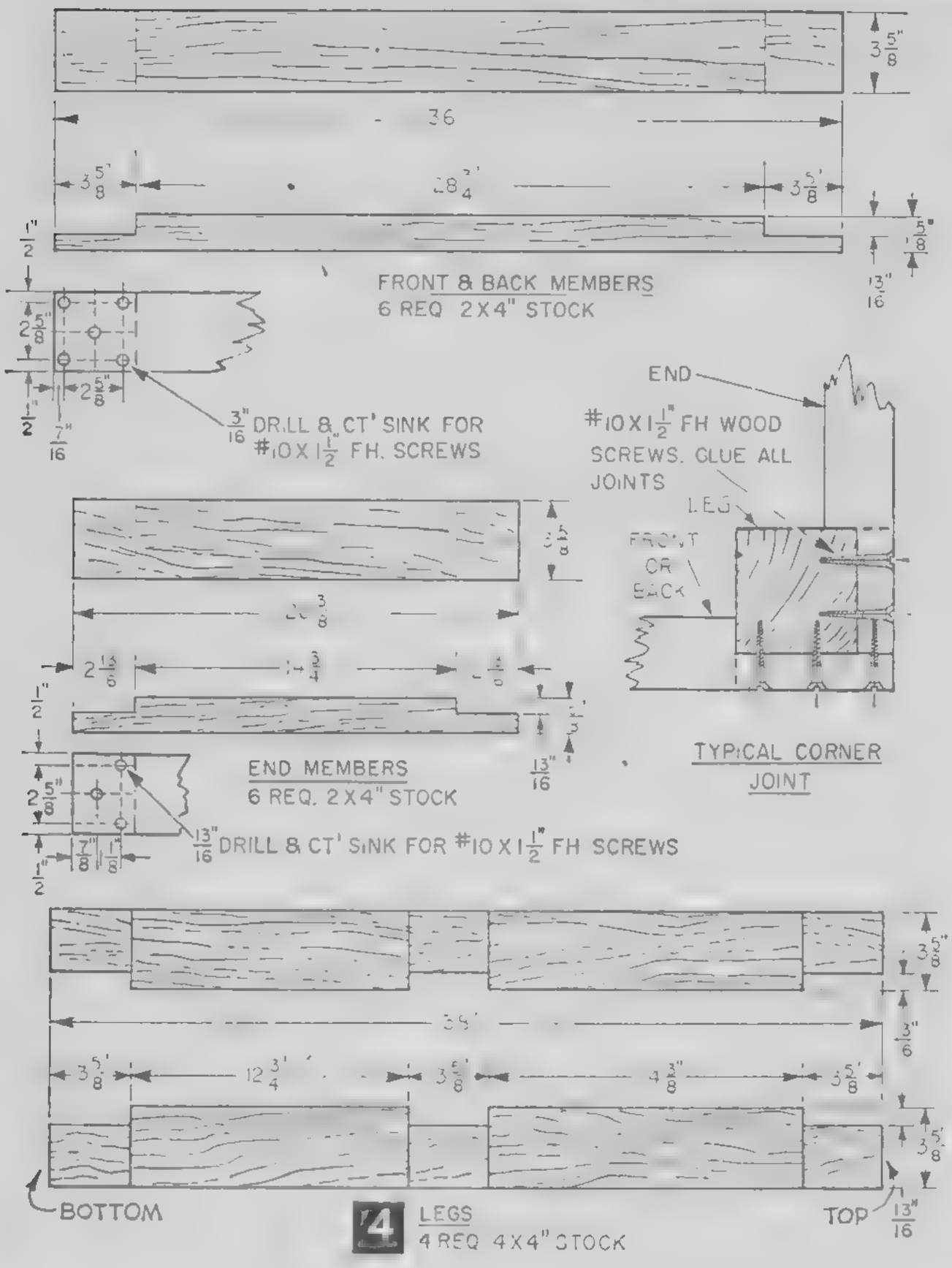
Since the mounting-hole spacing varies depending on the type of motor used, have someone hold the motor against the underside of the top while you mark the hole locations for drilling.. Make sure the motor pulley is in line with the 8 in. pulley on the upper deck shaft and the V-belt is taut when you mark the hole locations. Fasten motor with ¼-in. carriage bolts.

In Making the Tumbler Barrels, you have the choice of using tin cans or making up hexagonal-shaped wooden barrels. While the tin can type (Fig. 5), is far easier and cheaper to make, they require about 25% longer tumbling time than the wooden ones because of the slippery tin can sides. On the other hand, you'll need power tools to make the wooden barrels accurately enough to be watertight. But they'll provide faster grinding action because of the hexagonal shape and the fact that the abrasive grit tends to cling to the wooden barrel sides. We've tried both types and now use wooden barrels exclusively because of the faster grinding action.

When sawing the beveled sides on the wooden barrel segments (Fig. 6), set your bench or radial saw arbor at 30° and, unless you are using a hollow-ground combination

MATERIALS LIST—GEMSTONE TUMBLER

Amt. Req.	Description and Use
6	2 x 4 x 36" pine or hemlock for front and back members
6	2 x 4 x 20⅜" pine or hemlock for end members
4	4 x 4 x 38" pine or hemlock for table legs
1	¾ x 24 x 38" fir plywood for table top
100	#10 x 1½" fh wood screws
	WOODEN TUMBLER BARREL—FOR ONE
1	⅝ x 5 x 50" exterior fir plywood for barrel segments
3	¼" dia. x 10¼" steel rod for tie rod
9	¼"-20 hex nuts
9	¼" dia. cut washers
1	¾ x 12 x 24" exterior fir plywood for end discs
1	old inner tube for gaskets
	TIN CAN TUMBLER BARREL—FOR ONE
1	1 gal. size can
2	⅜ x ½ x 7" pine for tumbler strips
4	8-32 x ¾" machine screws
3	¼" dia. x 10" steel rods
9	¼"-20 hex nuts
9	¼" dia. washers
	TRANSMISSION FOR TWO DECKS
8	¾" pillow block bearings (Dodge Bronzoil or similar)
4	¾" x 36" cold rolled shafts
6	¾" bore. 2½" P.D. sheaves
1	¾" bore. 8" P.D. sheave
1	1½" P.D. Sheave with bore for motor
2	#3L-210 V-belt B. F. Goodrich
1	#3L-400 V-belt B. F. Goodrich
1	#3L-450 V-belt B. F. Goodrich
16	¼ x 1½" lag screws
1	¼ or ⅓ horse power motor
5	¾" dia. shaft collars



blade, make the 4½-in. width dimension about 1/32-in. oversize. This will allow enough stock to disc or belt sand the beveled saw-cut edges smooth enough to make a watertight joint.

To assemble the segments, make a jig by sawing 30° bevels on the long sides of a 2 ft. length of 2 by 6-in. stock and clamp it to the bench so that about 10 in. of it extends beyond the edge of the bench. Clamp one of the segments to the top of the jig as in Fig. 7 to hold it firmly in place as you fasten the adjacent segment to it with waterproof glue and six 1¼-in. finishing nails. After assembling six of the segments to make a complete barrel, set it aside until the glue has thoroughly dried. Then disc-sand the ends true and square with the sides.

Cut the barrel ends from ¾-in. plywood in the shape of 10-in. dia. discs as in Fig. 6. Since the ends also serve as "wheels" on which the tumbling barrel rotates, cut them on a band saw and, when disc sanding the edges, use a center jig (Fig. 6A) to make them uniform in size and in the shape of a true circle. Then lay out and drill the three ¼-in. holes in the barrel ends as in the end view Fig. 6, for the barrel tie rods.

Next, center and fasten the hexagon barrel to one of the end discs with glue and nails. Cut a gasket for the other end disc, which must be removable. Assemble this disc to the barrel with the tie rods as in Fig. 6. Draw up the tie rod nuts tightly and leave until glued end dries.

When the glue dries, remove the cover and fill with water for a test run. After replacing cover, put the barrel on the tumbler shafts and let it run for a couple of hours. If no leaks show up, the barrel is ready for the actual tumbling process. If a few small leaks develop, seal them with fiber glass and resin applied to the outside of the barrel.

Making Tin Can Tumbler Barrels. The one gallon cans can be readily obtained at any restaurant or service station. Select cans that are not over 8-in. long. Remove the can tops with a rotary can opener so the rim will be smooth and free from nicks. Leave the bottoms intact.

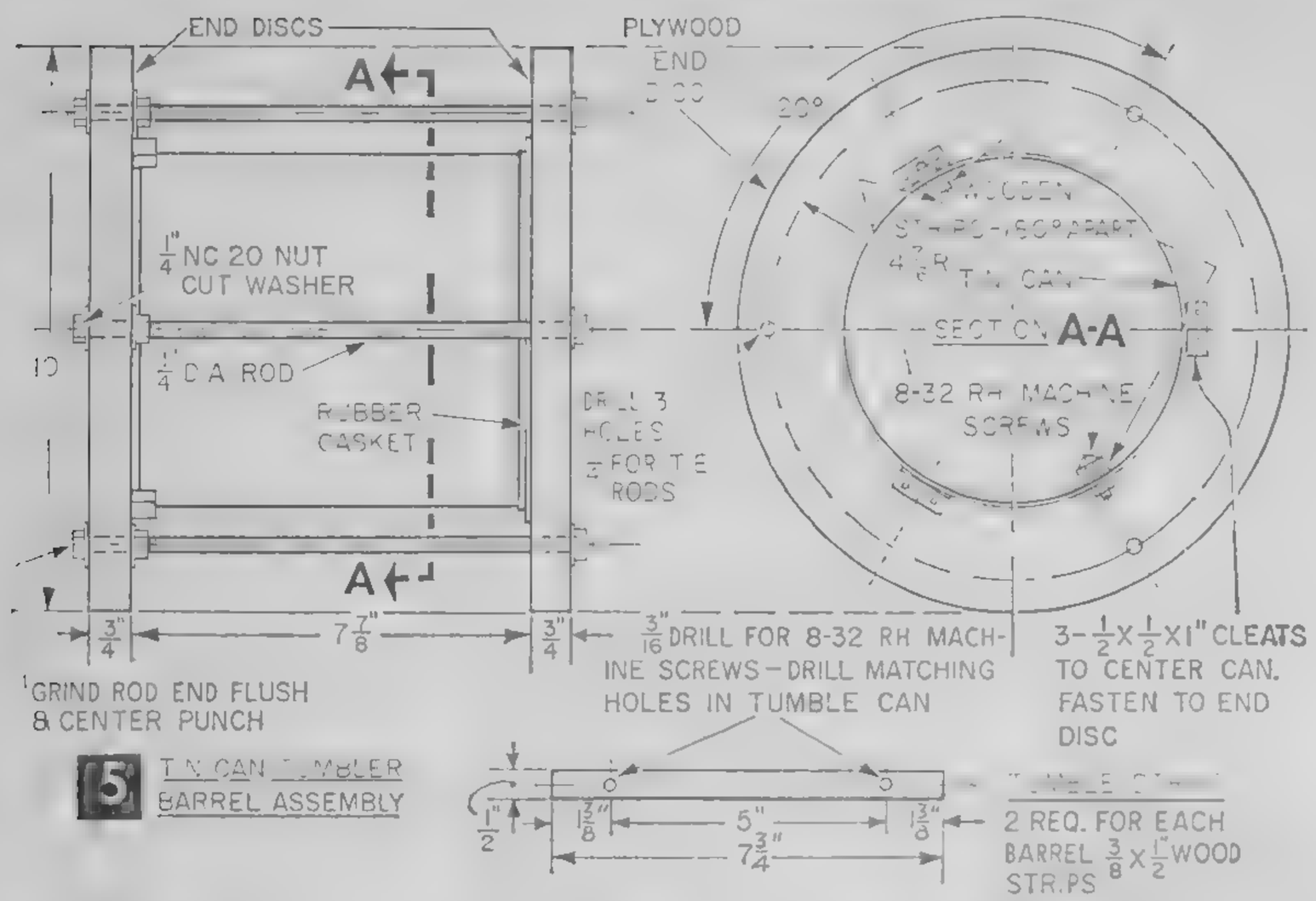
Make up two tumble strips as in Fig. 5, and fasten them to the inside of the can as in Sec. A-A Fig. 5. Use washers under the 8-32 screw nuts and tighten them so that the wooden strips seal the holes watertight.

The end discs are made the same as those used for the wooden barrels, and the same type of tie rods are used to assemble the tin can barrels. Cut a gasket from an old inner tube to place between the cover disc and the tin can. A test run to check for leaks is not necessary because the metal rim of the can assures a good tight seal.

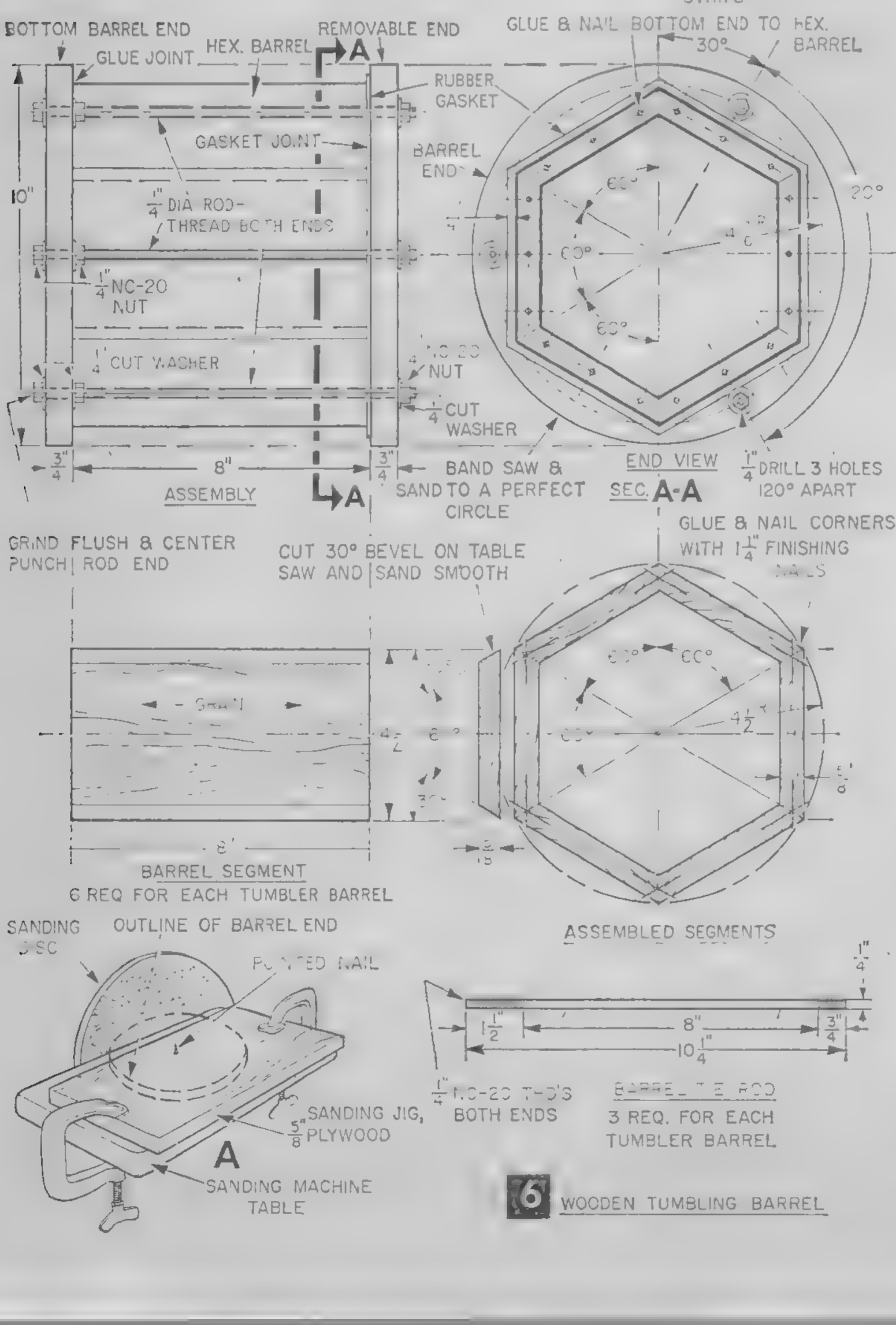
With 10-in. dia. discs, the tumbler barrels will rotate about 18 *rpm*. To exceed this speed would endanger the quality of the finished gems because it would make the stones strike one another with greater impact which would cause checking and chipping. Any speed slower than 18 *rpm* would prolong the tumbling time.

Operating the Tumbler. Before placing any stones in a tumbler barrel, segregate them into batches of uniform size. Mixing large stones with small ones causes uneven impact which may chip the small stones.

Broken and angular pieces of gemstone will not yield pleasingly shaped tumbled stones unless they are shaped on a grinding wheel before being tumbled. Grind off useless projection, grind out nicks, shape up the edges, and, in general, grind the pieces roughly into the shape you can use for jewelry. For baroque jewelry it is especially important that each piece have a small, well shaped neck that can be cemented into a cap as in Fig. 2.



5 TIN CAN TUMBLER BARREL ASSEMBLY

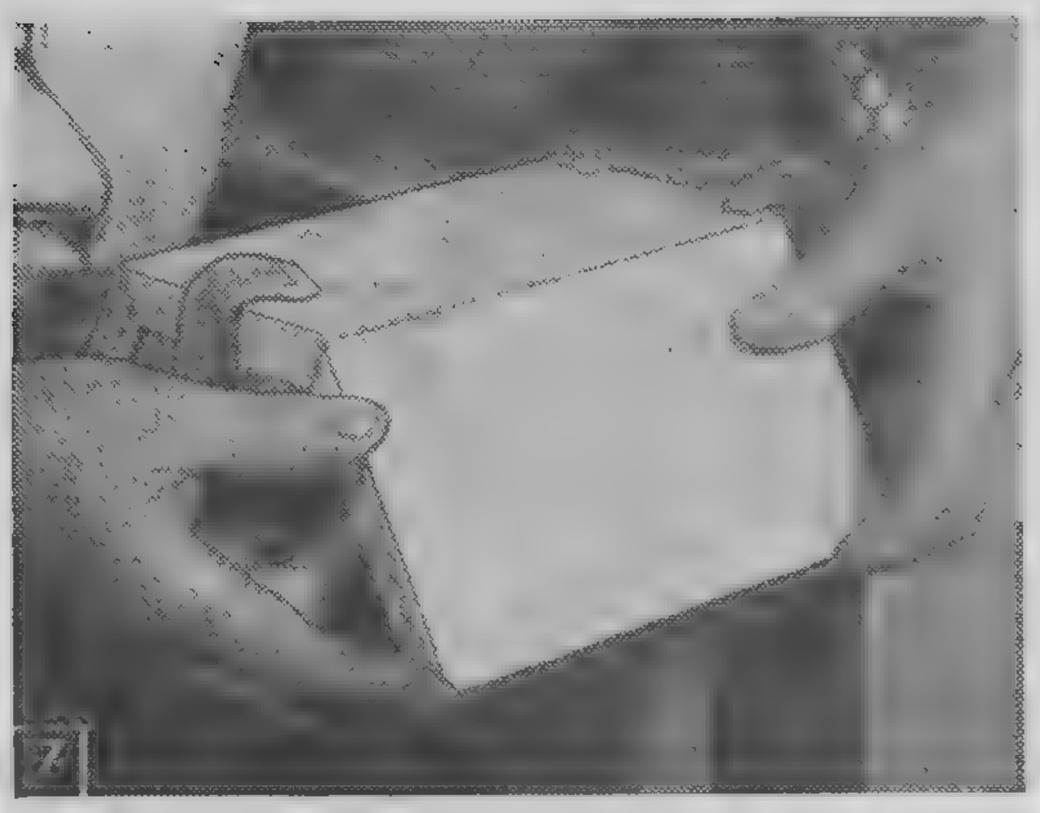


6 WOODEN TUMBLING BARREL

We gathered our stones on Oregon's famous Agate Beach where most of the stones have already been rounded and tumbled by the ocean. Thus, the tumbling time we used is a minimum, and more time will have to be allowed when tumbling angular stones. Polishing time can only be determined by inspection of the batch, since it varies even more than grinding time according to the nature of the stone. Soft and fragile gems like thomsonites wear away rapidly and should not be coarse ground at all. Start them with the fine grit cycle, then polish. On the other hand, some of the tough jaspers or jade will demand a long grinding cycle before they have a pleasing shape.

The First Tumble. Fill barrel to about one-half capacity with about 10 lbs. of stones. Add approximately 2 lbs. of 60/90 silicon carbide grit to the stones. Also add two heaping teaspoons of baking soda to the batch to counteract any gas formation which might occur during tumbling (a relatively rare condition which can occur with certain minerals, and which conceivably might cause an explosion in the tumbler barrel). Next fill barrel with water to the level of the stones. Clamp the cover on tightly and place on the live shafts of the tumbler.

The important first tumble should take at least 200 hours for stones found on the



When assembling the barrel segments, clamp one segment to the beveled 2 x 6 projecting from the bench top. Then glue and nail another segment to the clamped segment.

ocean beaches. For stones that are mined or are rough and disfigured, it may take an additional 100 hours to bring out a shapely contour.

Inspect at least every other day during the tumble (this applies to all tumbles, to be sure there is sufficient water and grit to maintain an efficient grind). At the completion of the tumbling cycle, thoroughly wash the barrel and stones free of rock and grit. Advance the stones to the next barrel for the next grind or second tumble. In the meantime, you can refill the first barrel as before with another fresh batch of stones scheduled for first tumbling.

The Second Tumble. Before placing the stones in the second tumbling barrel inspect them closely. Discard those which are inferior and return to the first tumble barrel those which need a little more tumbling time to bring out their best quality.

Place those that are ready for the second tumble in the barrel. Add 1½ lbs. of 3F or 4F size grit, one heaping teaspoon of baking soda, and water as before. Bolt the cover tight and place on the tumbler shafts.

The tumbling time on the second tumble should be at least 100 hours. This is the in-between tumble. It transforms the rough ground surface of the stone to a satin finish that will readily polish. Inspect the tumble regularly to determine when the stones attain this finish, adding water as the tumble progresses, if necessary.

At the end of the tumbling cycle, again wash the stones and barrel thoroughly, as any grit left in the batch will hinder the polishing. Discard chipped or inferior stones. A chipped stone in the polish run will damage other stones. Handle the stones with care so you do not nick or chip them.

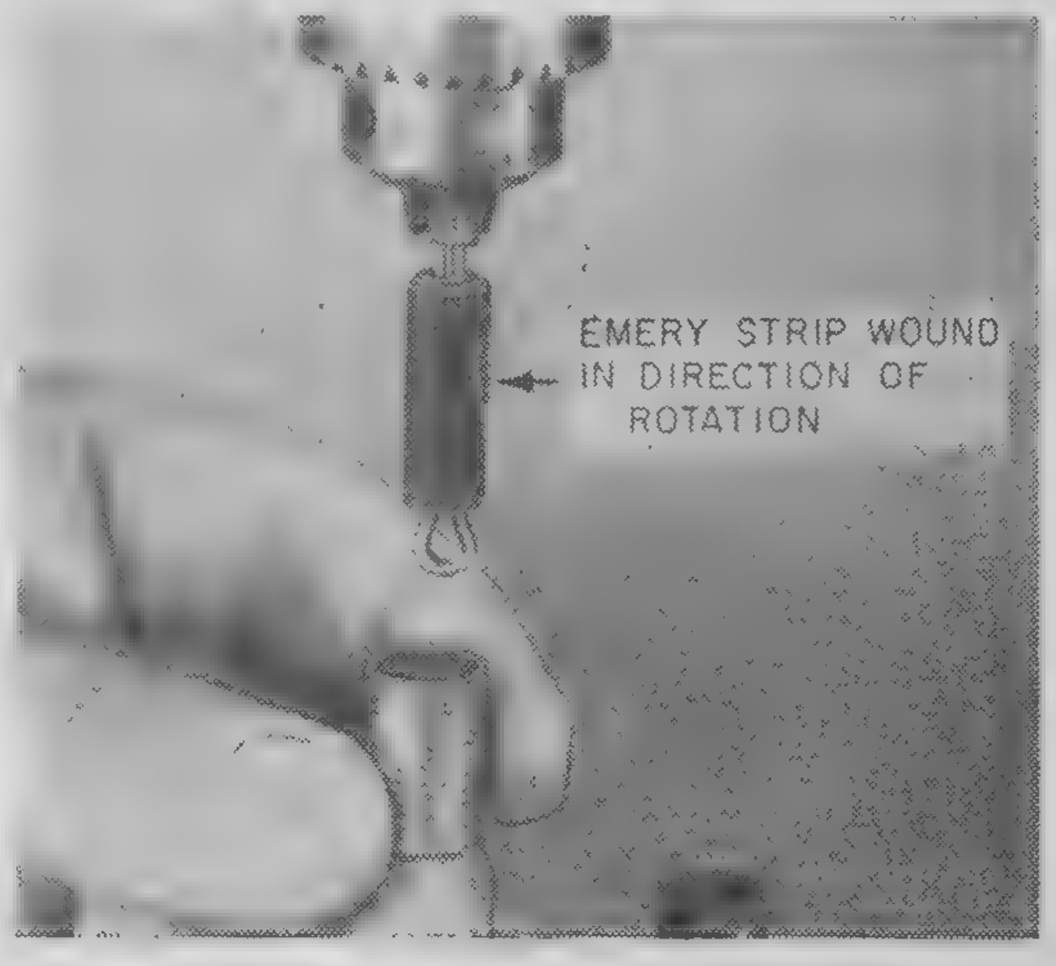
The Third Tumble. This is the polishing tumble. Place the stones in the third barrel adding 1-1½ lbs. of Alumina or Tin Oxide polishing powder and sufficient water to make a light paste like sour cream. The paste should be heavy enough to cushion the stones on impact and still be light enough to permit their sliding by each other without sticking together. Again tumble and inspect. If the two previous tumbles have shaped and ground the stones properly, the stones should be brought to a high polish in about 100 hours, possibly less. Watch the water and the paste, keeping it creamy all through the polish. Stones that have attained their polish will shine like a mirror. At the end of the tumbling cycle wash both the barrel and the stones thoroughly.

The Fourth Tumble. Return the stones to the third barrel adding one-quarter of a small box of *Tide*. This is a cleansing and a finish polishing cycle and should be completed in 50 hours. At the end of the cycle, wash with fresh running water to remove the soap and lay out on an absorbent paper to dry.

Handle with care—you now have a few pounds of highly polished baroque gems that will hold their own in any company. The grinding compounds used in each tumbling cycle are available from lapidary supply houses, listed in the classified ad section of this and other magazines.

Improvised Internal Abrasive

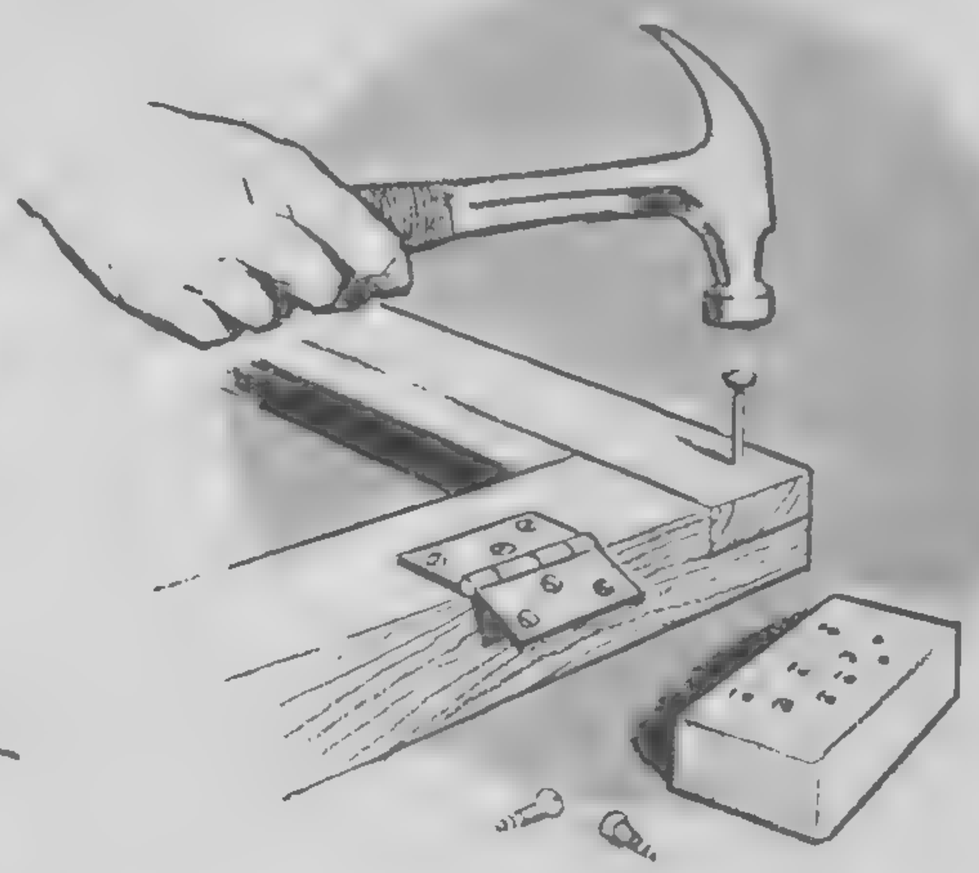
• When the necessity of polishing or removing burrs from small bushings or other bored work arises and the correct size reamer is not at hand, make an abrasive tool from a strip of emery cloth and a cotter pin. Insert the strip of abrasive between the legs of the cotter pin and wrap it in the direction it will rotate in your drill press until it is almost the diameter of the bore. Then hold the strip tightly and insert it in the work before turning on the drill. For a more permanent tool, use a sanding-disc adhesive to secure the coiled abrasive strip in place.—Bil Toman.



in your WORKSHOP

Makes many jobs easier, try these—

If your handsaw binds, rub soap on both sides of the blade. It will go through the wood a lot easier.



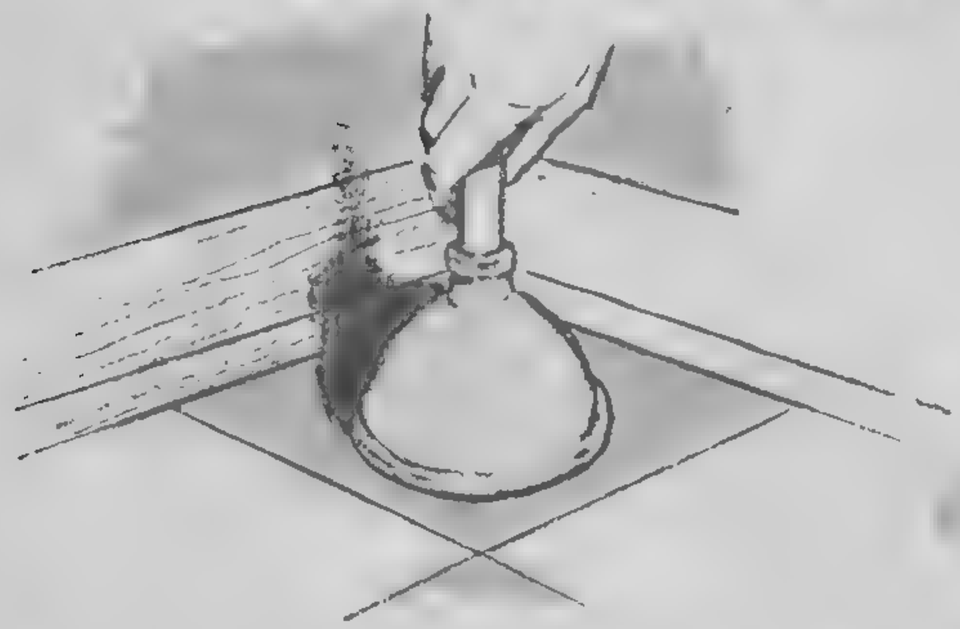
When nailing in hardwood, stick the nails into soap first to make the job of driving them easier. Rub woodscrews on a bar of soap, and you can drive them with less effort.

Keep screw-type caps on parts-jars and other containers from sticking by coating the threads lightly with soap.

Pick up tacks or tiny parts with a bar of soap, and scrape the bar to free the tacks or parts. You can pick up broken glass this way too, then cut off the part of the bar with the glass in it.

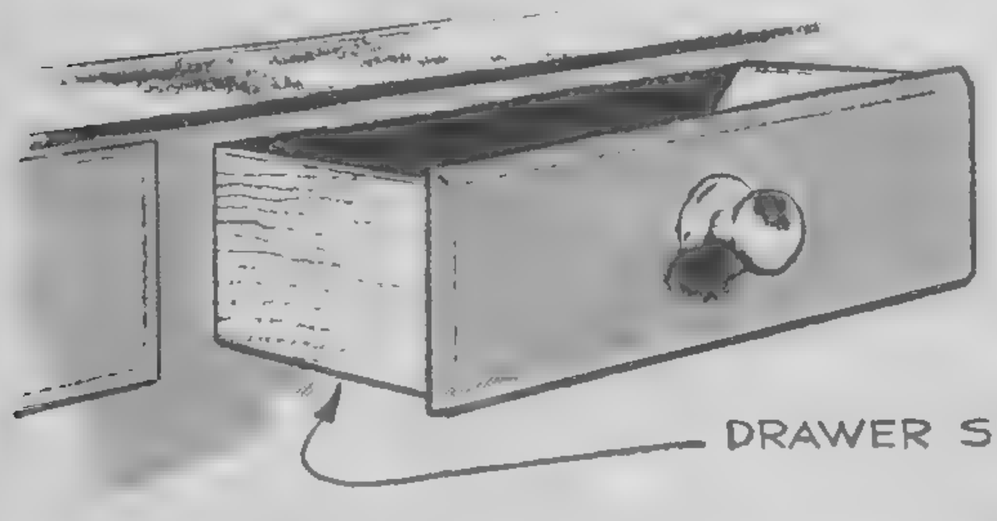
Decanter stoppers don't stick when you rub a little soap on them.

It makes some things STICK and some things SLIP



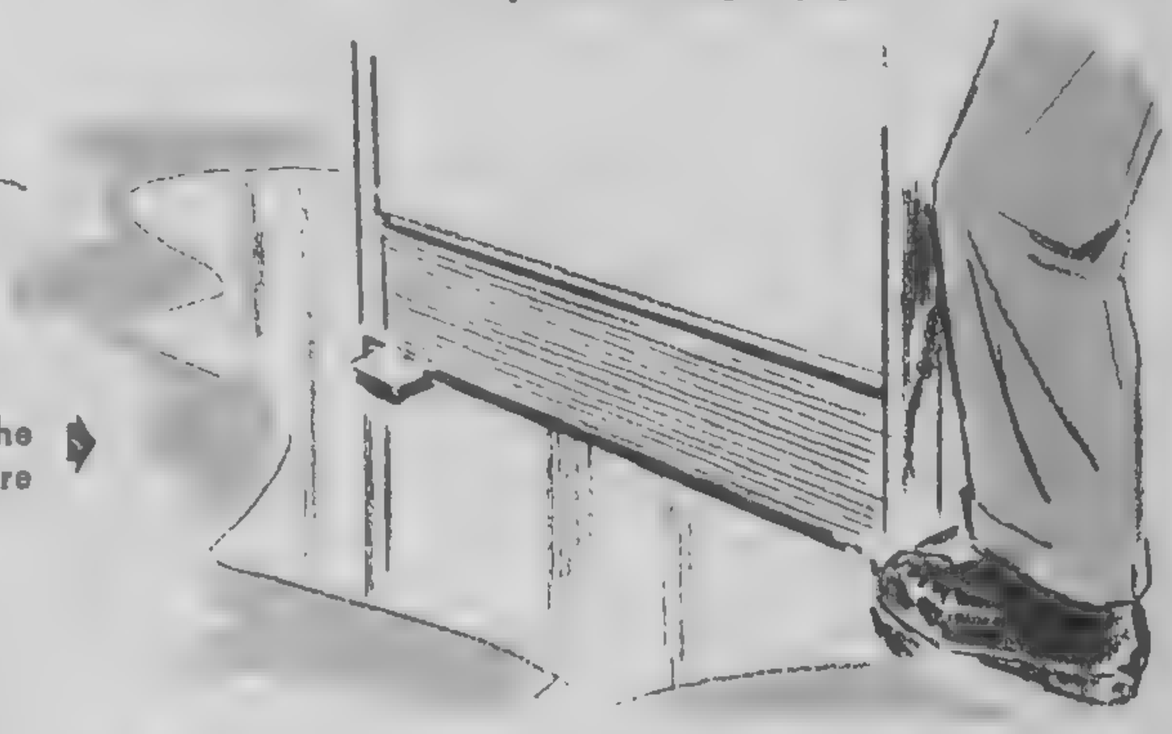
When you need to move the refrigerator, soap the floor in front of it, and you can slide it out more easily.

Use soap to make suction cups on small kitchen racks stick to the wall better.

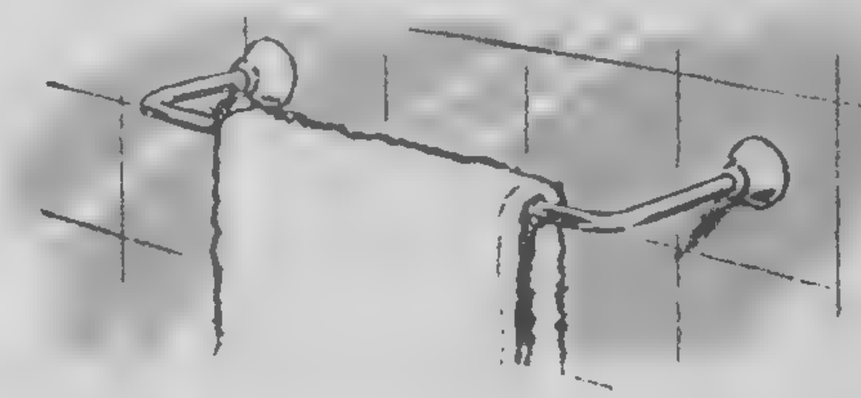


Mask switch plates, door knobs, and other room hardware with a soapy film before painting, and paint spots can be wiped off easily later.

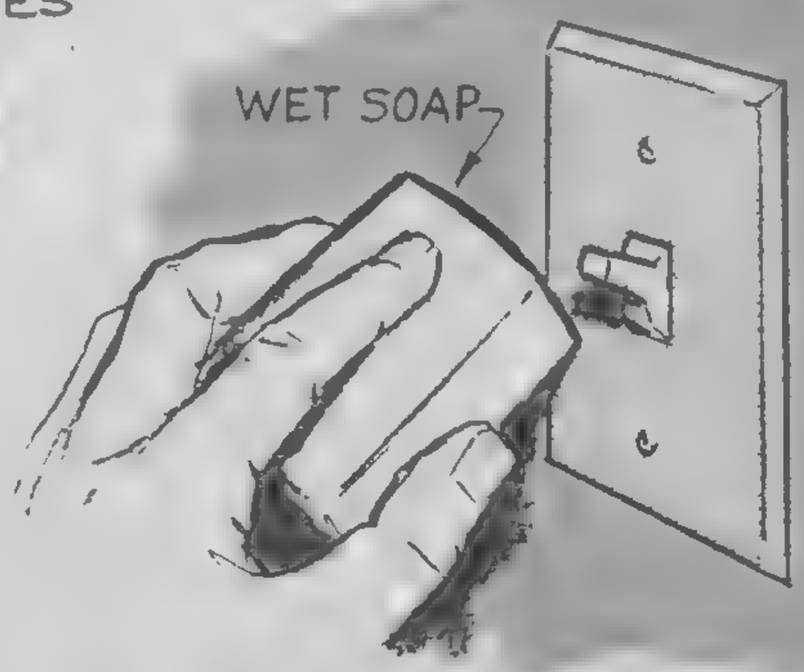
Having a struggle trying to lift linoleum from a tight-fitting corner? Rub soap around the edge of a plunger to provide a tight grip.



Before painting, or working on a greasy job, rake your fingernails across a bar of soap. Saves clean-up time.



Sticky drawers will slide freely if you soap the drawer slides. And you can lubricate a stubborn window-sash (or cupboard door) with soap, too.



Soak your paintbrushes overnight in very soapy water, rinse in the morning, and dry.

—GRACE ARNOLD

Showcase gun rack made of hardwood plywood is an effective addition to any den or game room when finished to blend with other furniture. Modifications for other sports are shown at right.

Sportsman's

GUN CABINET

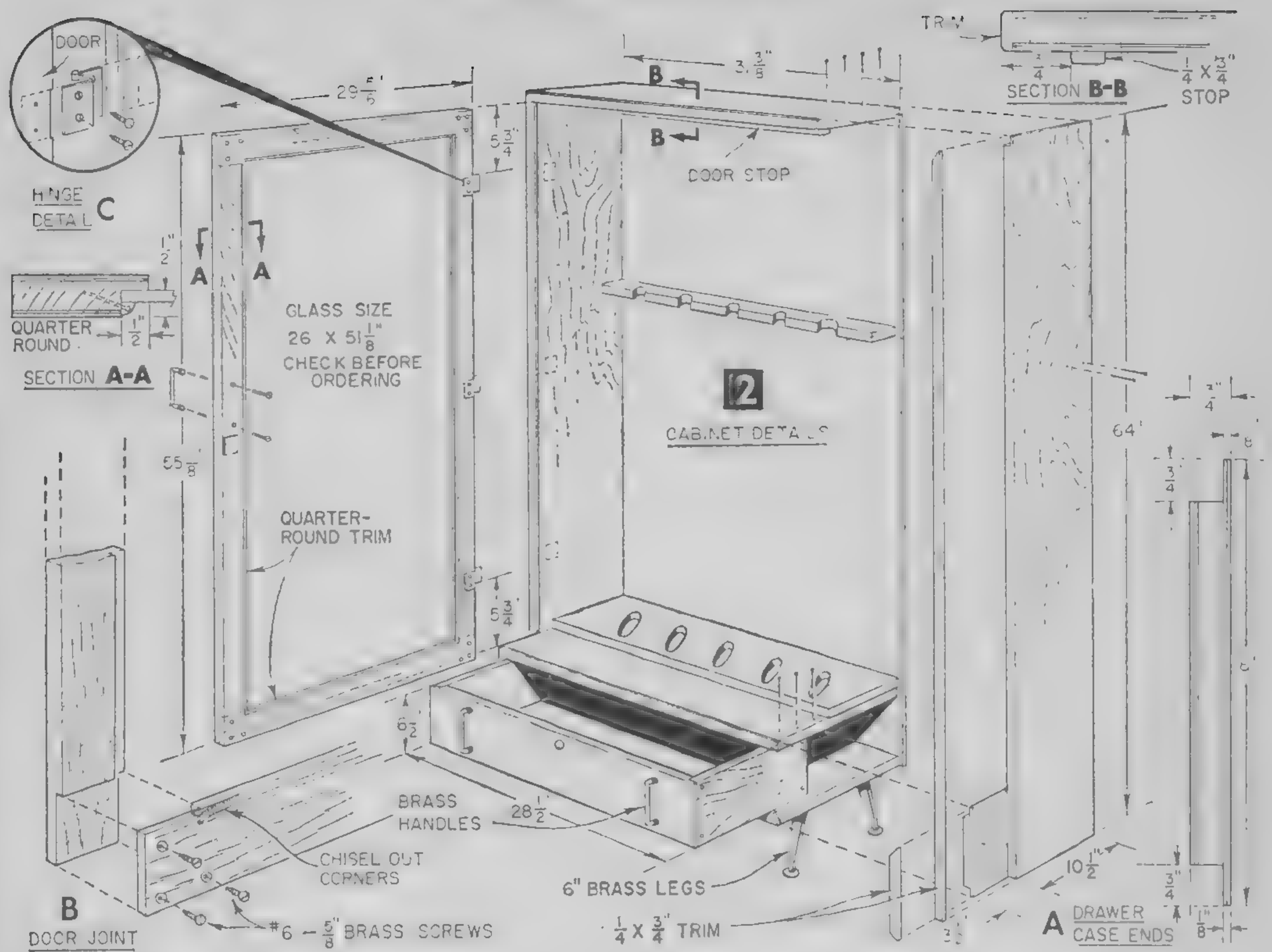
By DAVE SWARTWOUT

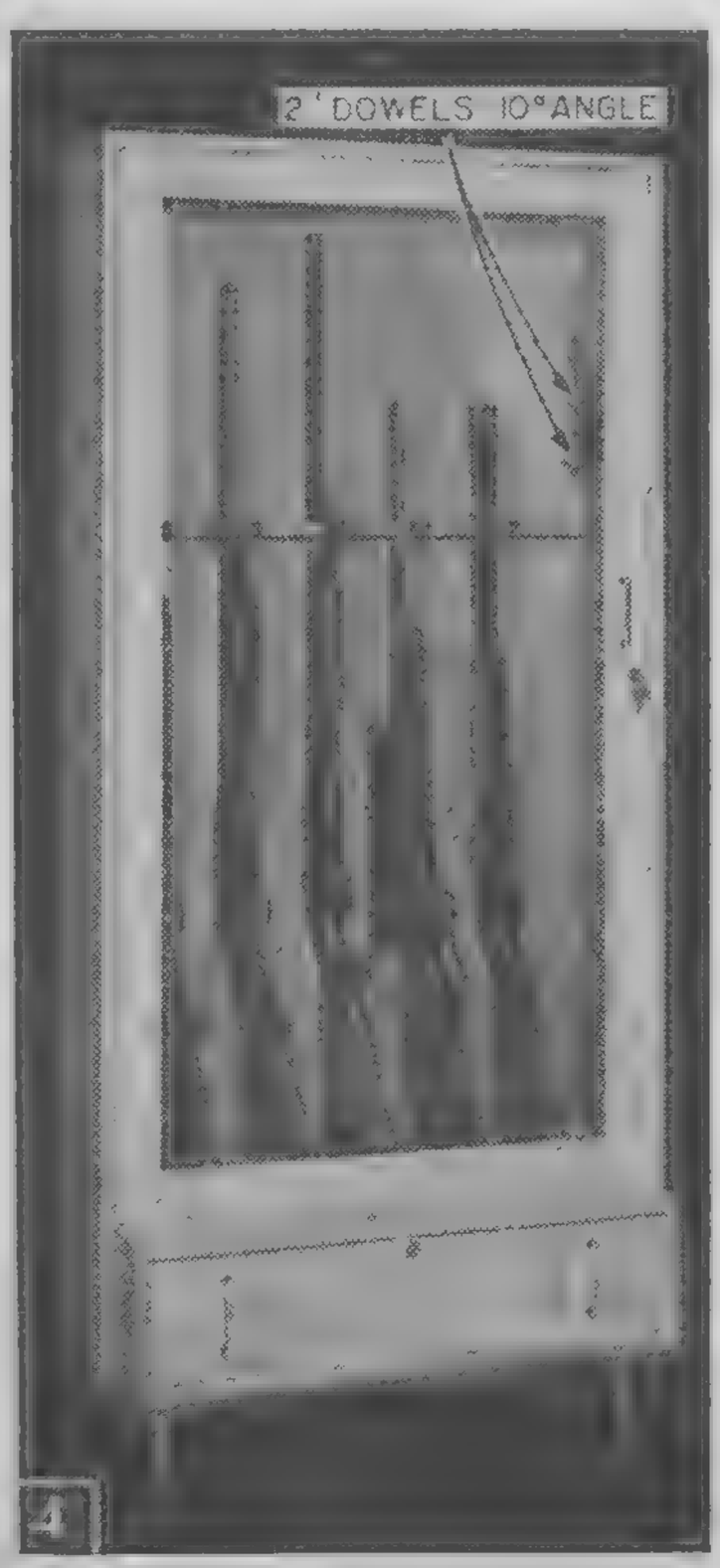
YOUR wife can't stand your hunting gear in every unused corner of the house? Here is a gun cabinet she will be proud of as a piece of furniture and you will too.

It is a handsome way to display your guns as well as providing locked storage for your ammunition. It is one of the safest ways to keep guns away from children, of any age, who may be running about the house.

The gun cabinet is easy to build using a circular power saw but will require considerable skill if you plan to use a hand saw. The cabinet shown here was made from one sheet of ¾-in. lumber-core, white ash plywood. If desired, you can use 1-in. stock lumber except for the back panel.

Although the cabinet was designed primarily for guns, with





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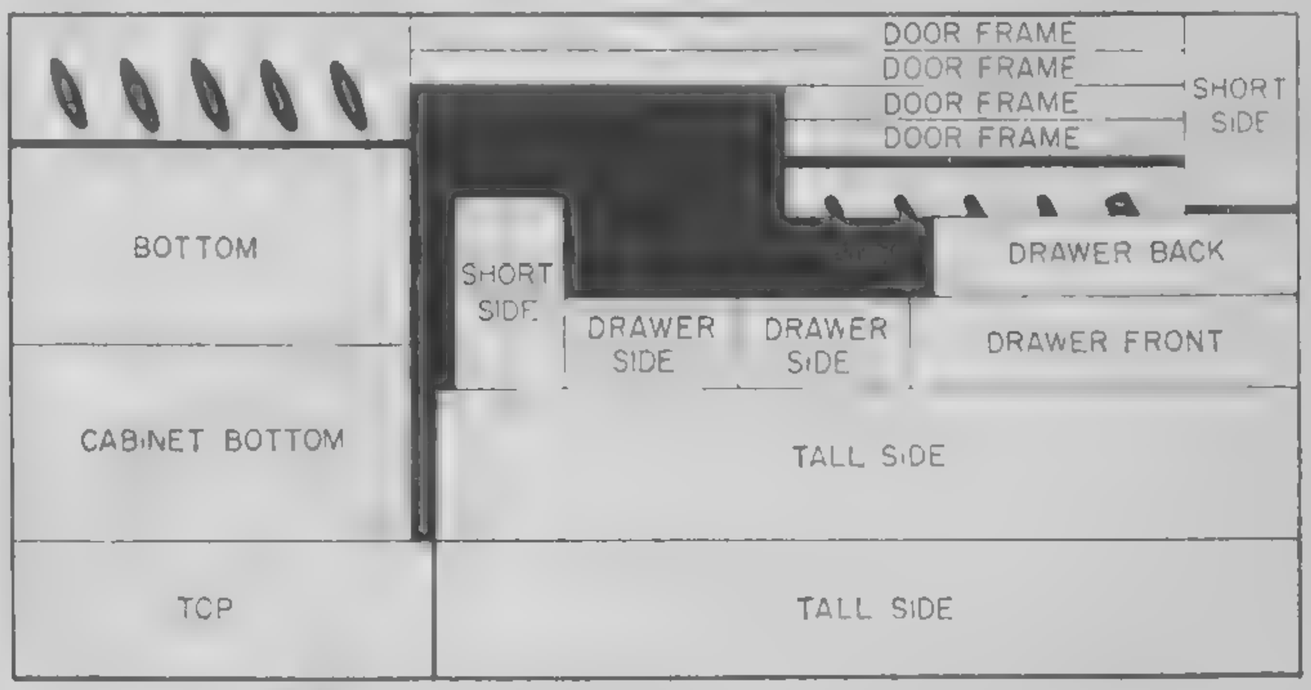
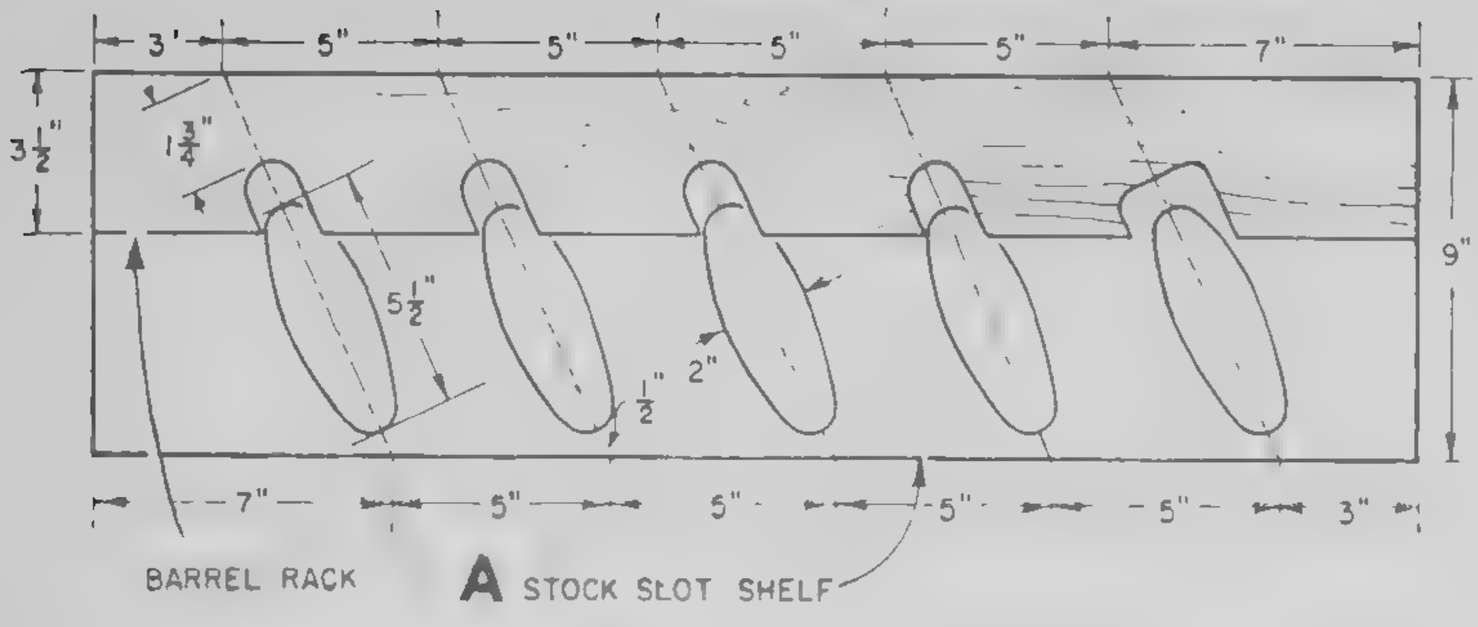


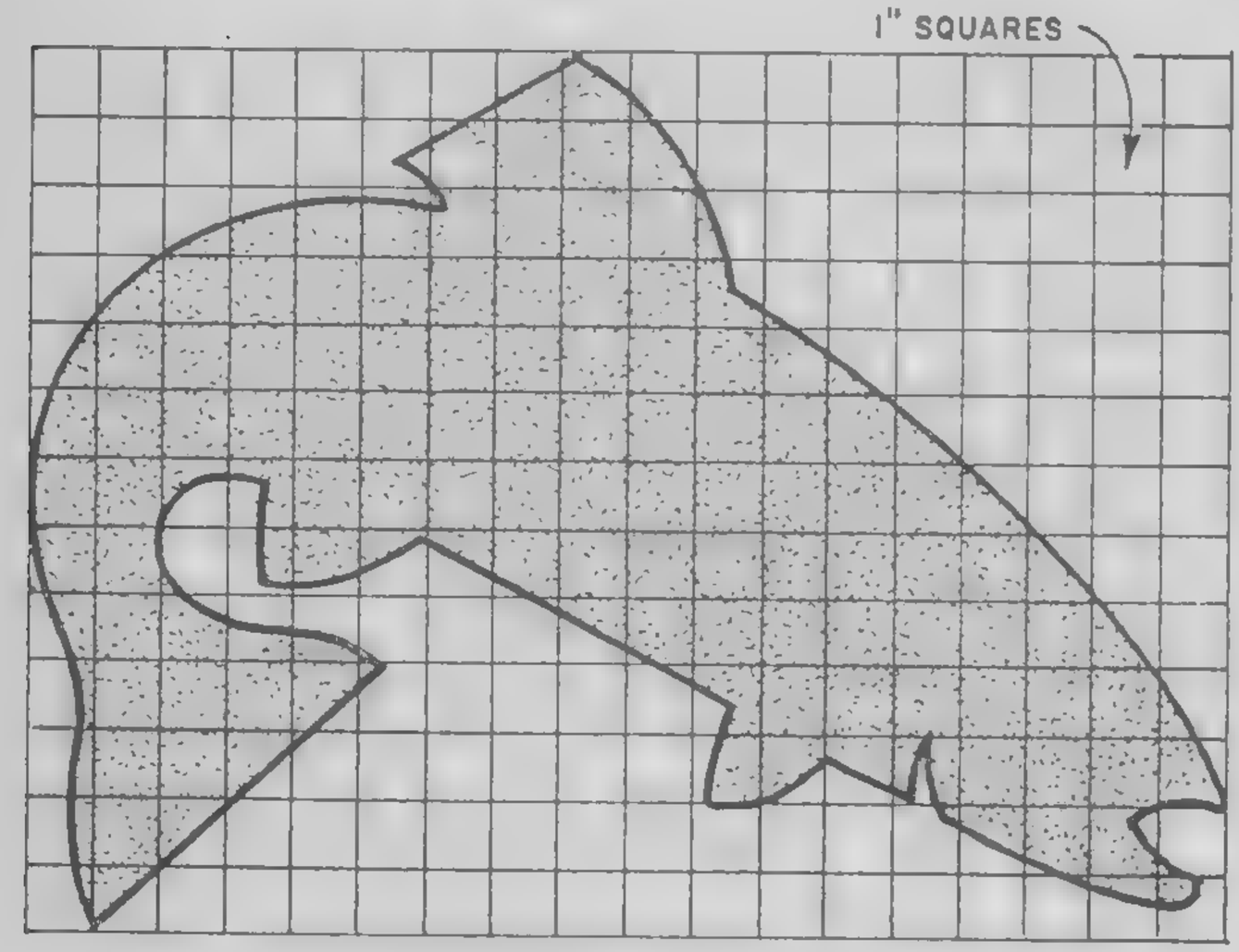
3 CUTTING DIAGRAM FOR 3/4" X 4" X 8" PLYWOOD

Materials List—Gun Cabinet

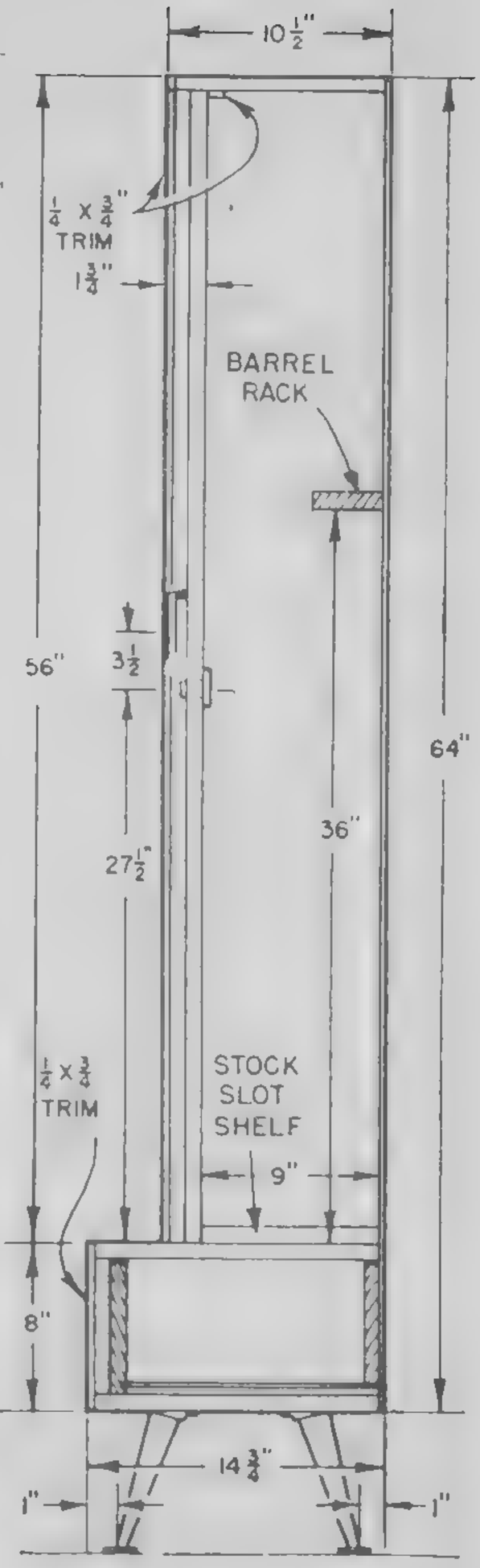
No. Req.	Size and Description
1 pc	3/4" x 4 x 8' lumber core hardwood plywood (cabinet, drawer)
1 pc	1/4" x 4 x 6' plywood in matching finish (back, drawer bottom)
2 pcs	1/4" x 8' quarter-round molding (glass stop)
1 pc	double-strength glass (to fit door)
4	6-in. brass tapered legs (or wood with brass ferrules)
3	3/4-in. brass offset cabinet hinges
3	brass handles (door, drawer)
2	brass cabinet locks (door, drawer)
4	1/4 x 3/4" x 6' hardwood strip (cabinet edge trim, door stop)
1 sq. ft.	heavy dark brown felt (barrel rack slots)
30	#10 x 1 1/4" *fh* (flathead) wood screws (drawer case, drawer)
12	#6 x 5/8" *fh* brass screws (door frame)
Misc.	finishing nails, lath nails, brads, screws, glue

Cabinet sides offer display space for several pistols, hung on slanted dowels cut from matching hardwood.





C CORK PANEL LAYOUT



B PROFILE SECTION

15

a few interior changes it becomes a model display case, fishing cabinet, or combination hunting-fishing unit as in Fig. 1A, B and C.

Panel Cutouts and Rabbets. Obtain all the materials specified in the Materials List except the glass. Saw out the various panels from the ¾-in. plywood to dimensions in Figs. 2 and 7, using Fig. 3 as a guide.

Saw rabbets in the ends of panels with dado blades or two cuts using a planer blade in your circular saw. Also rabbet back edges of the outer cabinet panels to fit the ¼-in. back panel, and side panels of the drawer case for the bottom and shelf panels. Rabbeting in this way allows maximum support with minimum end grain showing. Edges will be covered later with matching trim strips mitered at corners.

Cabinet Assembly. Screw-fasten end panels of the drawer case to the tall cabinet side panels as in Fig. 2A so the bottom edges are flush and the rear edge of the drawer case is flush with the back rabbet of the side panels. Screw from the inside out, using five #10 x 1¼-in. flathead (*fh*) screws on each end, after drilling pilot and clearance holes and countersinking for each screw.

Install the drawer case bottom and top panels with glue and the same size screws so that both are flush with the back rabbet of the drawer case side panels. Screws through top of panel of the drawer case should be placed far enough back so that the stock slot shelf will cover them. Use 6*d* finishing nails at the front edge. Attach cabinet top similarly with 6*d* finishing nails and glue.

Cut a 31 x 64-in. piece of ¼-in. plywood for the back so it will just fit into the side back rabbets and be flush with the bottom of the drawer case. Fasten this back panel well in place with glue and lath nails. It will square and stiffen the cabinet against racking.

To make the door frame, rip the ¾ x 2½-in. door frame pieces, then cut ½ in. sq. rabbets in all four sides to take the glass and saw or rout half laps for corner joints as in

Drawer across base holds heavy equipment.

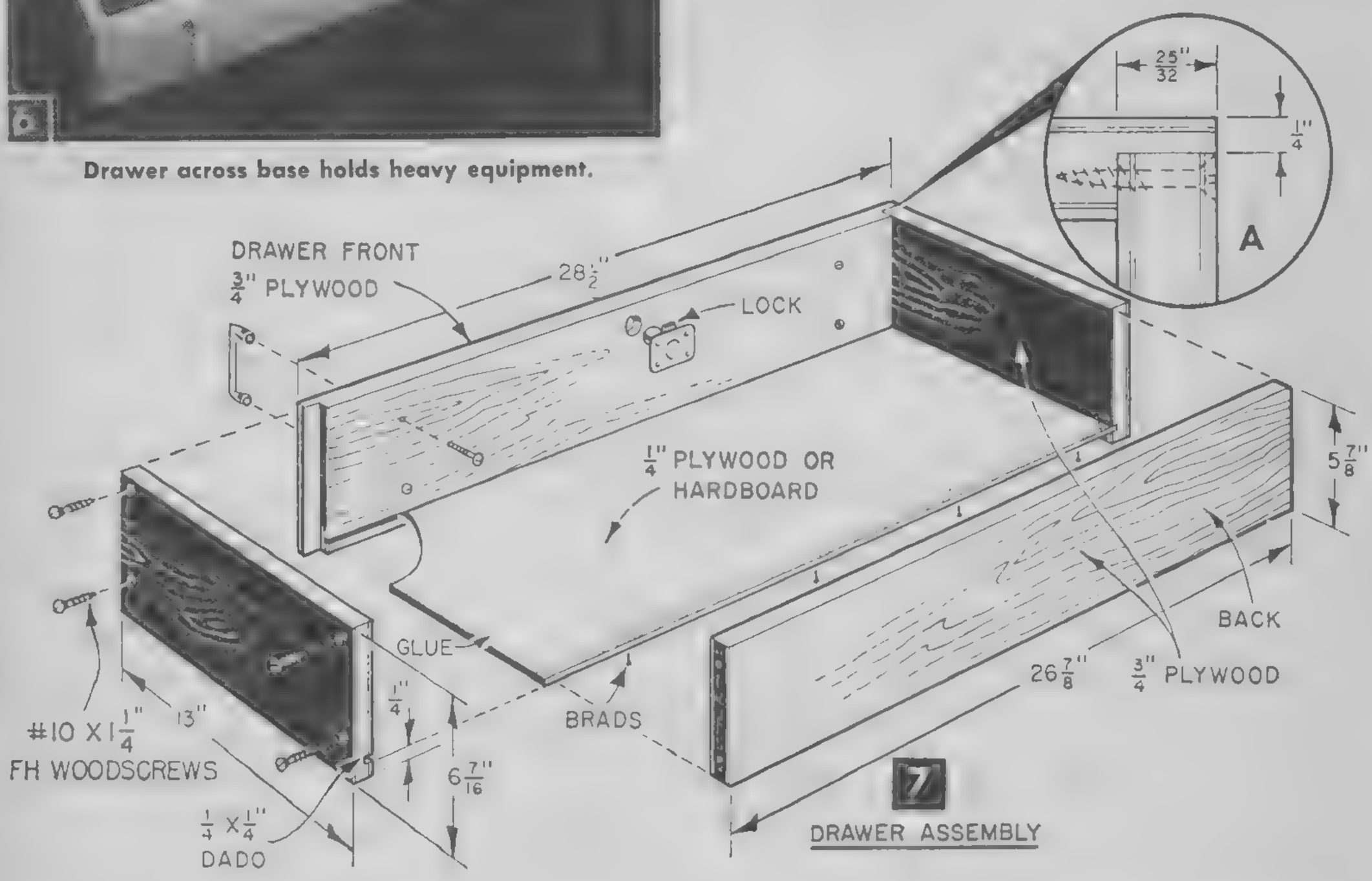


Fig. 2B. Use three #6 x ⅝-in. brass screws and glue to hold each corner.

After the door frame is completed, hang it on three cabinet offset hinges as in Fig. 2C. Fit door so that it clears cabinet the thickness of a dime on all sides. Brad in trim for a door stop as in Section B-B of Fig. 2, then install the door lock.

Now you can measure the opening, buy the glass and install it with ¼-in. quarter-round molding as in Section A-A of Fig. 2.

Make the drawer by rabbeting and dadoing the front sides as in Figs. 6 and 7. Assemble with glue and screw ends to front and rear sides, after drilling 3/16-in. shank holes and ⅛-in. pilot holes. For the 12 x 28-in. bottom use ¼-in. plywood or tempered hardboard. Install the drawer lock and cabinet handles.

Saw the Barrel Rack and stock slot shelf from ¾-in. plywood as in Fig. 5A. Form the slots in both boards; first by drilling 1-in. holes at the slot ends, then sawing out the excess with a coping saw or jig saw. Line slots with dark brown felt to protect the barrels. Glue and nail the shelves in place as in Fig. 5B, using 4*d* finishing nails through the back and sides.

To add pistol pegs to the cabinet, drill ¼-in. holes in side panels at a 5 to 10° angle for 2-in. long dowels of matching wood as in Fig. 4.

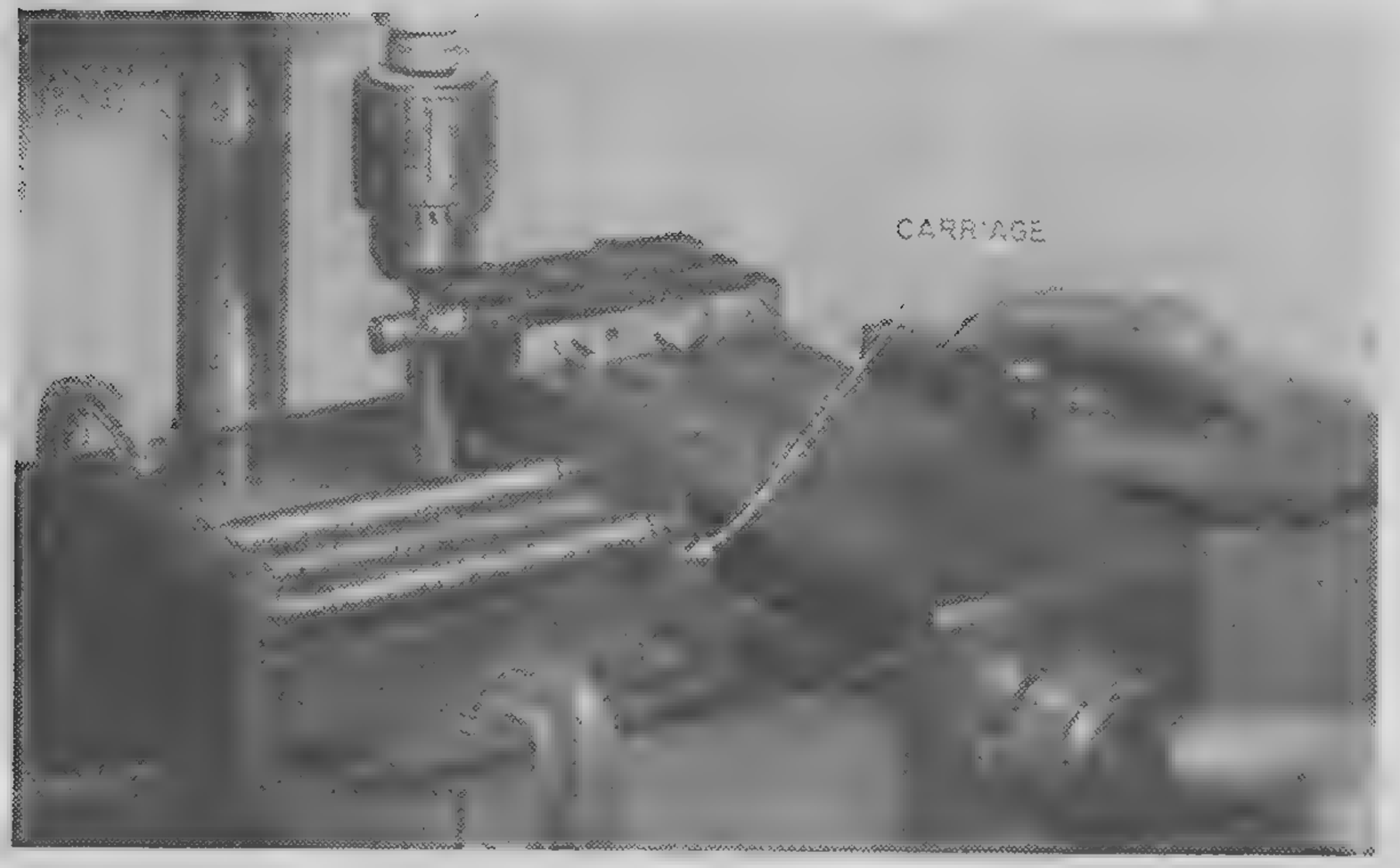
If you plan to use the cabinet for a fishing or trophy cabinet (Fig. 1A, B and C), tailor shelves to suit your needs from ¾-in. plywood or 1-in. lumber. For photos or lures, glue a cork panel to part of the rear wall. For special shape panels prepare a template on paper or cardboard, using 1-in. squares, as in Fig. 5C.

Trim the edges of the plywood with ¼ x ¾-in. strips of the same type wood as the plywood (Figs. 2A, 5B). Add the locks and handles, attaching from the back sides of door and drawer.

Screw-fasten the legs in place 3-in. from the sides so that they are parallel to the sides. Locate the feet or ferrules about 1-in. from a plumb line dropped from front and back of the cabinet.

The work done, we finished our cabinet with spar varnish. You might prefer to match yours with the wood trim.

Caution. Unfamiliar hands with access to an unlocked gun cabinet can be more dangerous than an armed burglar. So keep your cabinet locked—and carry the key with you.



Cutting a keyway in a piece of cold-rolled shafting is easy with the compound table. In this set-up, depth of the cut is controlled with the left hand lead-screw, while the work is advanced with the right hand lead-screw.

Compound
Drilling and Milling Table

Space drilled holes accurately, and do milling, grinding, and keyway-cutting on your drill press with this compound table attachment

By WILLIAM H. GRUBB

WITH no power tool except your drill press, you can make this compound table at a cost of less than $15.00, and with it do the work of compound attachments costing much more.

For instance, suppose you want to drill two holes in a piece of work exactly 2-in. center-to-center. Secure the compound base plate to the drill press table, clamp the work piece in the vise, and line up and drill the first hole. Then traverse the compound in the proper direction with one of the lead screws (40 turns for 2 in.), and drill the second hole. It will be 2000 thousandths-of-an-inch from the first, if your compound attachment is carefully made. This is accuracy you can't get by ordinary measuring means. You can also do key-seating, as shown in the photo, and other light milling operations in your drill press with this attachment, providing the run-out of your drill press spindle is not excessive. The design takes advantage of the precise dimensions to which cold rolled steel is manufactured, eliminating the need for any machine work other than drilling.

Get the steel parts (see Materials List) sawn to correct length, if possible, when you buy them from your local steel supply house. This will leave only hand filing of the ends to finish the pieces. Note that only the two 3-in. long carriage plates (Figs. 3 and 5) require exact squareness of the ends, as only the ends of these two parts are used as mating surfaces with other parts. Use a machinist's try-square to check the trueness of the ends, and take care to get these pieces exactly the same length as well as square. Squareness and matching length is more important than that they be exactly 3-in. long—they could be slightly longer or shorter than this without harm. Elsewhere in the structure, the ends of the cold rolled parts are in the open and need to be trued up only to the extent of producing a neat, workmanlike appearance. (The ends of the ways, although they are adjacent to the end plates, are not attached to them.)

File the ends of all the cold rolled pieces, then lay out the drilling pattern on two of the end plates (Fig. 3) and mark them for identification. Stack together one of these marked plates with two 4-in. carriage plates and an unmarked end plate, in the same relation to each other they will bear in the completed structure (Figs. 4A and 1). Line up their edges with a try-square, using the ⅜ x ½-in. gib stock to establish the ½-in. inset of the carriage plate edges from the end plate edges (Fig. 4).

Clamp the four pieces solidly together, then drill the guide rod holes through all four plates, first with a small drill (about 3/16 in.), following up with a larger drill and finishing with the correct size drill. In drilling these holes, greater accuracy will be had if one of

the guide rod holes is finished through all four plates, and then plugged with a piece of the ½-in. guide rod stock while the next hole is being drilled. Drill the lead screw hole through three plates, but only halfway through the fourth, to ½-20 tap drill size (29/64 in.). Then unclamp and drill this hole to ½ in. in the first, second, and fourth plates. Tap the 29/64-in. hole ½-20 in the third plate (the second carriage plate), then lay out, drill, and tap the gib screw holes in the other carriage plate. Stack, clamp up, and drill the second set of end plates and carriage plates in the same manner as the first set (Fig. 4B). Next, lay out, drill, and tap the guide rod set screw holes in the four end plates (Fig. 3).

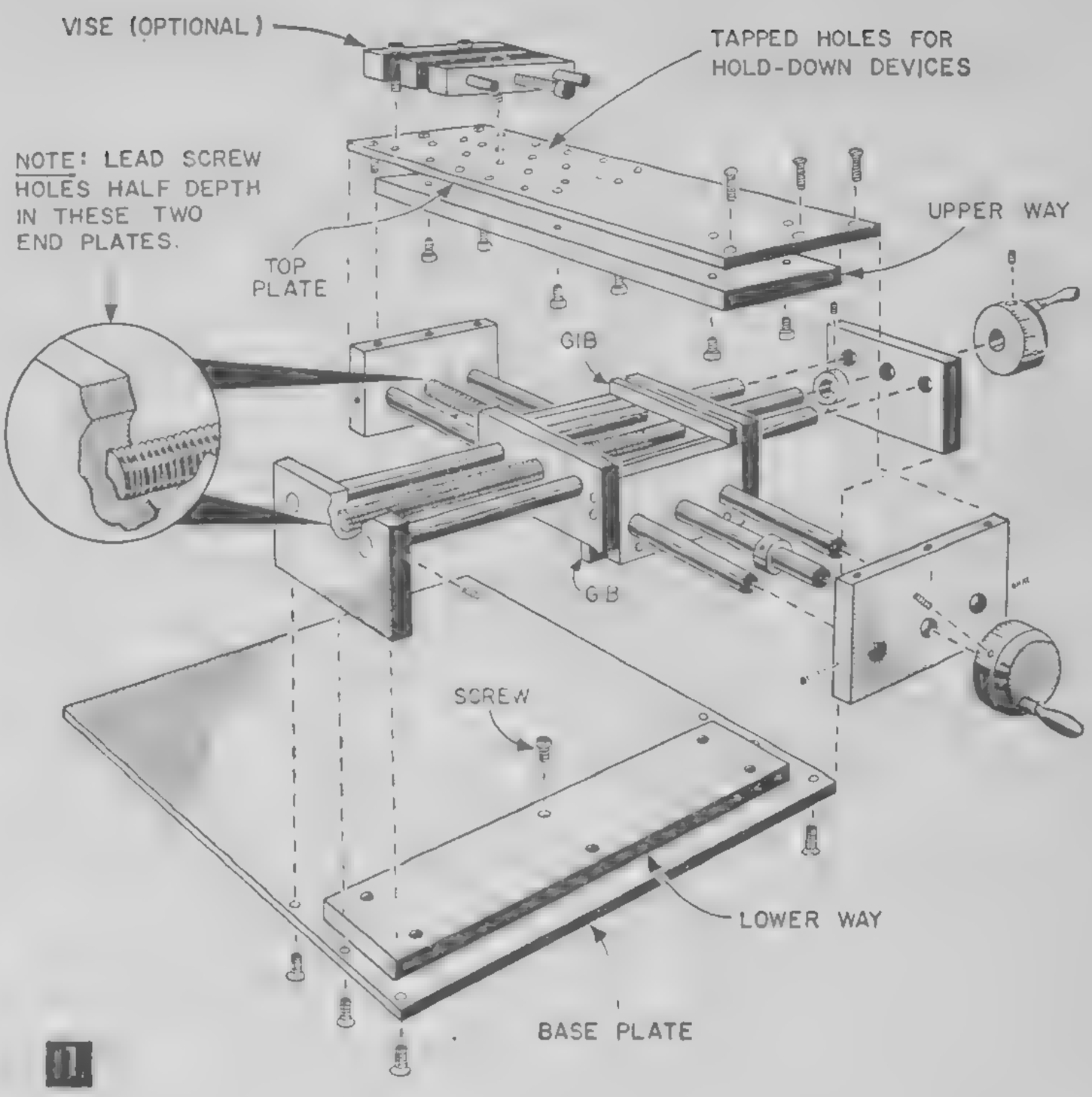


Fig. 4A

Smooth up the edges of the base plate and clamp one of the ways to it, spacing it from the edges according to Fig. 2. Lay out the six screw holes on the way, and drill through the way and base plate to tap drill size (#8). Then remove the way and drill and counterbore the holes to finished size, to receive the ¼-in. *sh* (socket head) capscrews. Be sure to recess these screw heads fully into the way so the carriage plates will not touch them when the table is traversed. Tap the screw holes in the base plate, then attach the way to it with six capscrews.

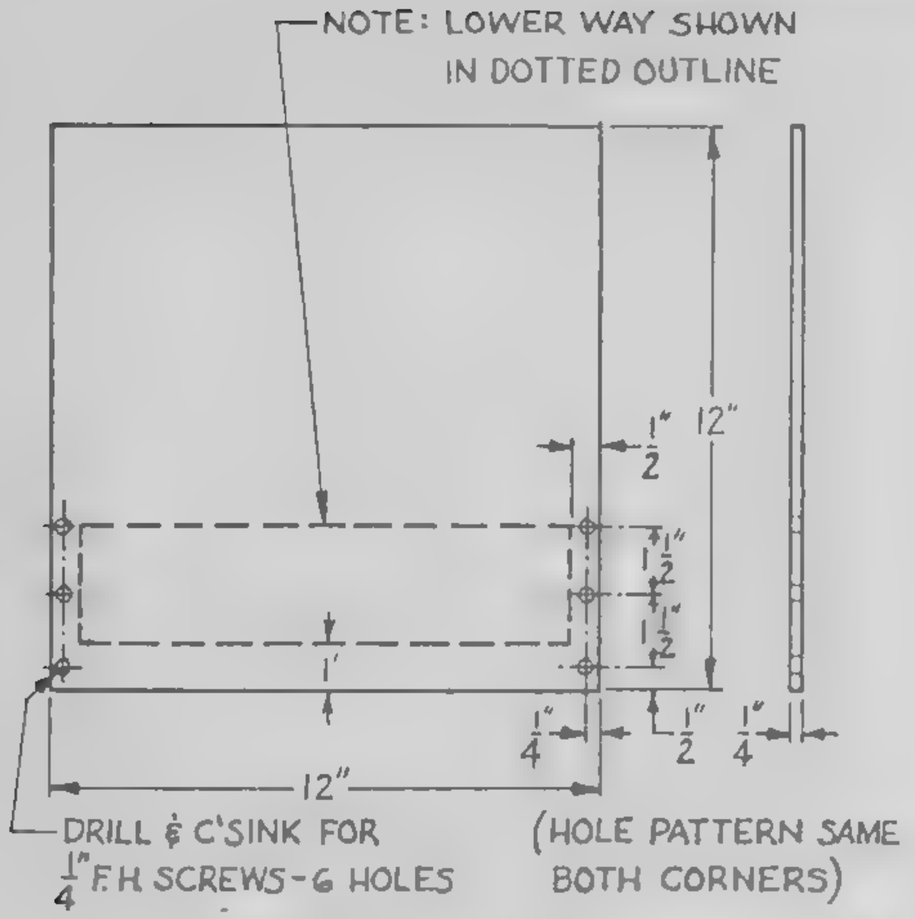
Make the top plate next (Figs. 2 and 2A), noting the hole layout in its surface which provides for the attachment of the fixed and moveable vise jaws and other work-holding devices. Drill and tap these holes first, then clamp the way to the top plate and drill and tap the six screw holes for the attaching holes, following the same procedure as for the lower way.

Next, clamp up the four plates comprising the carriage, taking care to get the ½-in. offset of the plates exact (Fig. 5) and the plates at 90° to each other. Insert the ½-in. guide rods to aid in holding opposite plates in line. If you got the ends of the 3-in. carriage plates perfectly square when you filed them, you will have no trouble with this line-up; if not, it will be necessary now to true them up. Then drill and tap for the eight ¼-20 *sh* capscrews, counterboring to recess the screw heads.

Note that the two gibs (Figs. 5A and 1) offset the carriage with respect to the upper and lower ways. Install the lower gib and set the carriage and one end plate on one end of the lower way, orienting it properly, then insert the guide rods to hold the parts in alignment and clamp the assembly together. Drill, tap, and countersink the three screw holes in the underside of the base plate

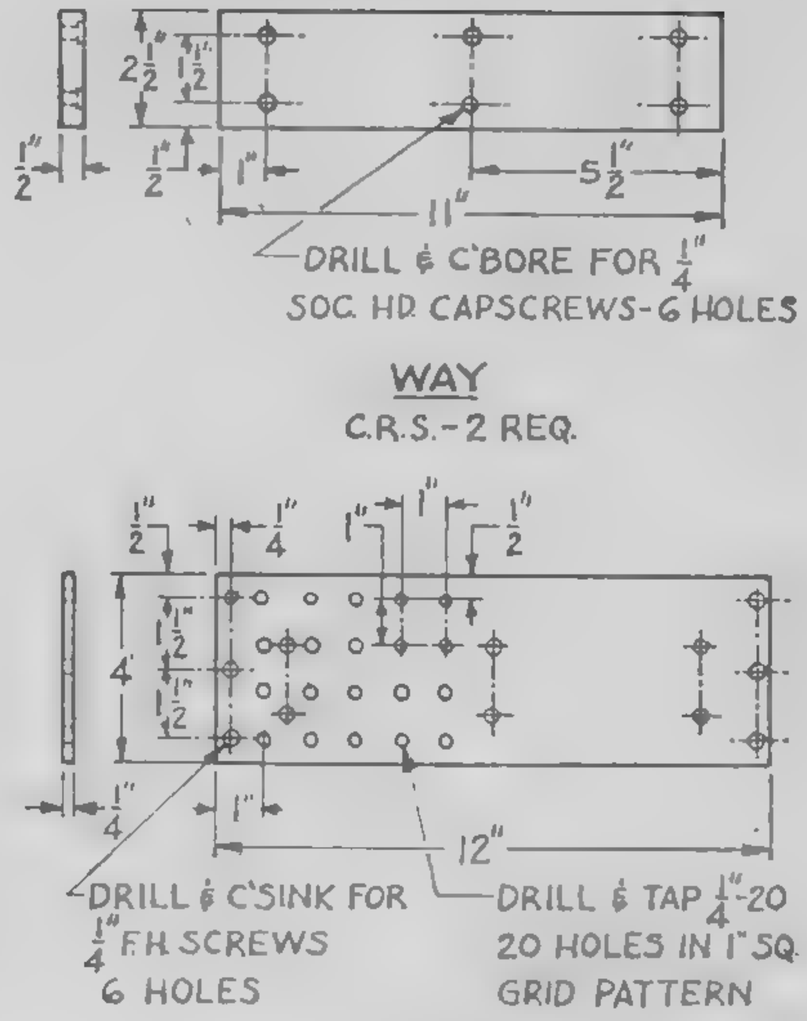
MATERIALS LIST—COMPOUND TABLE

No. Req.	Size and Description	Use
	STEEL	
1	¼ x 4 x 12" long CRS (cold rolled steel)	top plate
2	½ x 2½ x 11" long CRS	ways
4	½ x 2½ x 4" long CRS	end plates
2	½ x 2 x 4" long CRS	carriage plates
2	½ x 2 x 3" long CRS	carriage plates
3	¾ x ¾ x 4" long CRS	vise
2	⅜ x ½ x 4" long CRS	gibs
4	½" dia. x 12" long CRS	guide rods
2	½" dia. x 12½" long CRS	lead screws
2	1 5/16" dia. x 1¼ long CRS	handwheels
2	⅜" dia. x 2½" long CRS	spinning handles
2	¼" dia. x 2" long CRS	vise
2	½" I.D. x ½" long collars	lead screws
1	¼ x 12 x 12" HRS (hot rolled steel)	base plate
	FASTENINGS	
23	¼–20 x ¾" *sh* (socket head) capscrews	carriage, ways, vise
12	¼–20 x 1" *fh* (flat head) machine screws	end plates
14	¼–20 x ½" *sh* setscrews	guide rods, gibs, handles
2	6–32 x ¼" *sh* setscrews	spinning handles
1	¼-20 x 2" *sh* setscrews	vise



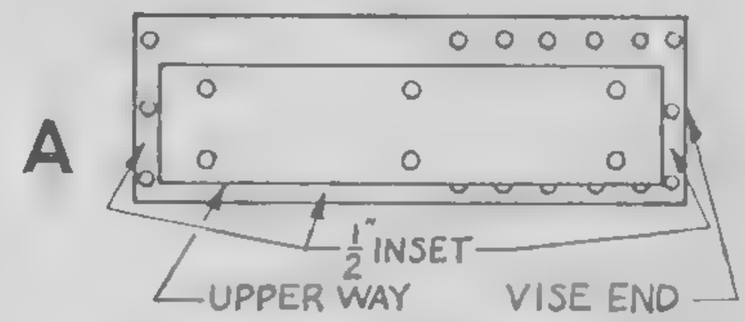
BASE PLATE
H.R.S.

2

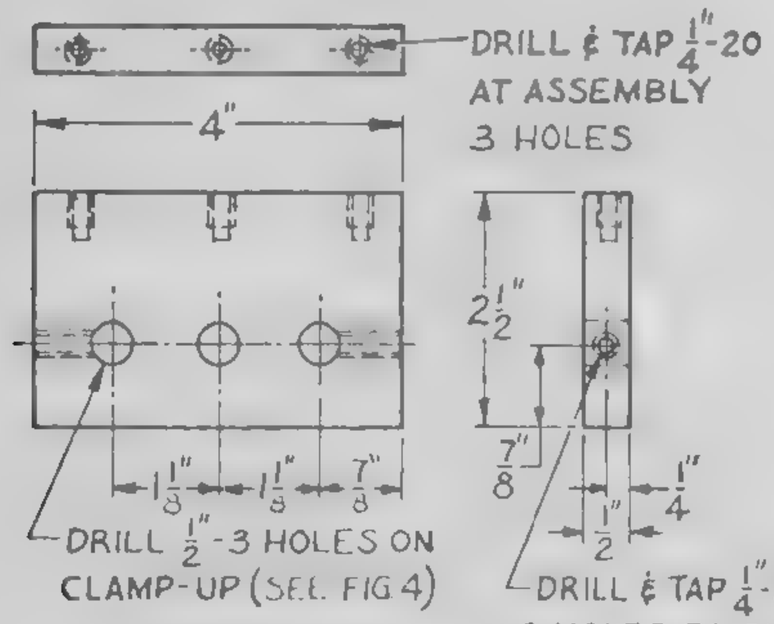


WAY
C.R.S. - 2 REQ.

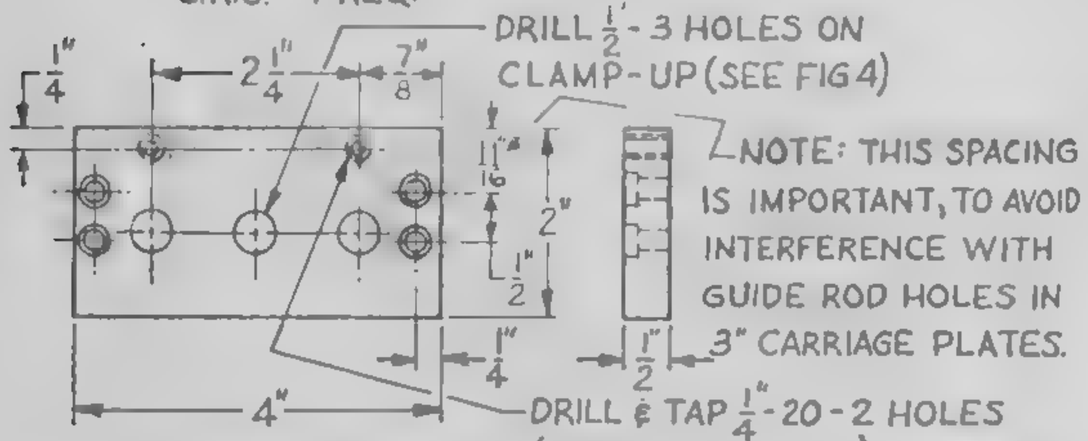
TOP PLATE
C.R.S.



TOP PLATE, UNDERNEATH VIEW
(NOTE RELATION OF WAY TO VISE END OF TOP PLATE.)

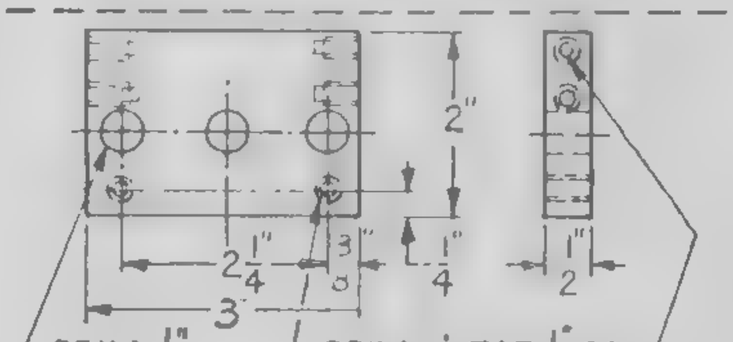


END PLATE
C.R.S. - 4 REQ.



4" CARRIAGE PLATE
C.R.S. - 2 REQ.

3

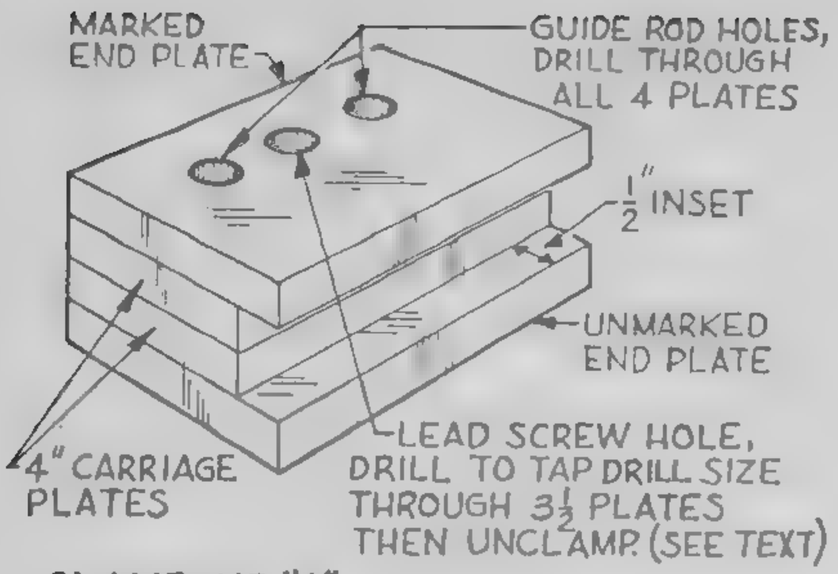


3" CARRIAGE PLATE
C.R.S. - 2 REQ.

and insert the screws. Slide the carriage to the opposite end of the way and repeat the procedure to secure the other end plate.

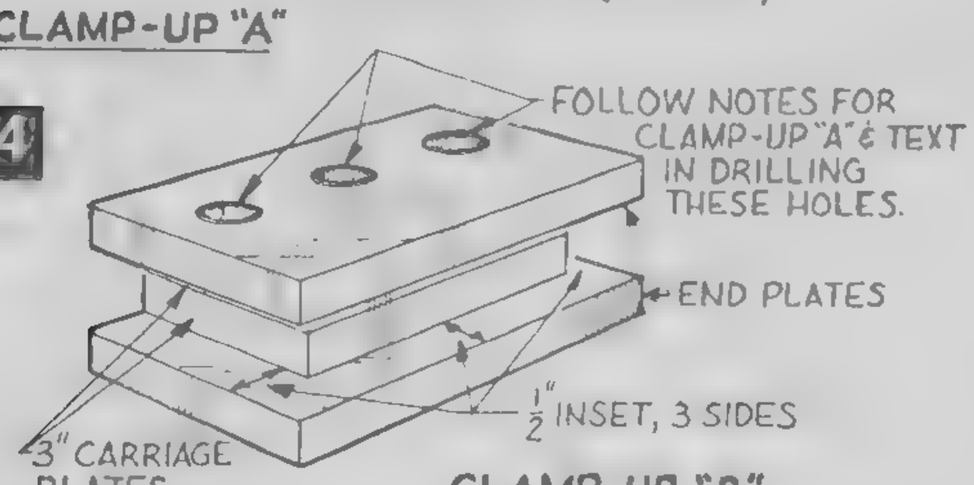
Then install the end plates on the top plate, following this same method. As the ends of the ways are not attached to the end plates, squareness of these ends is not a factor in controlling the trueness of these assemblies. After all four end plates are installed, slide the carriage back and forth on the lower way, and slide the top plate back and forth on the carriage. If there is any binding, correct it by bringing the out-of-square parts into true with paper or brass shims (Fig. 5), or if the binding is very slight, by applying fine automotive valve-grinding compound to the guide rods and sliding the parts back and forth.

Make the Handwheels next (Fig. 6). Turn these on a lathe if you have one, but if not you can make them on the drill press if the pieces have been sawn fairly square. Drill the ½-in. center hole and the ¼-20 set screw hole in the handwheel blanks first (Fig. 6). Then chuck a piece of ½-in. cold-rolled rod in the drill press, put a handwheel blank on it, and use a file to form the chamfer and fin-

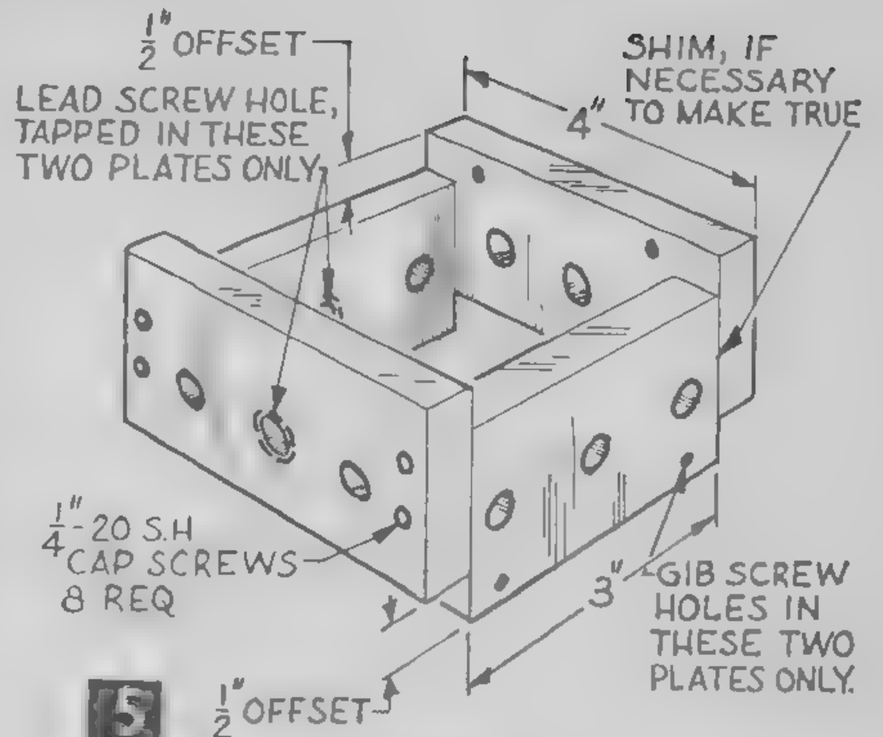


CLAMP-UP "A"

4



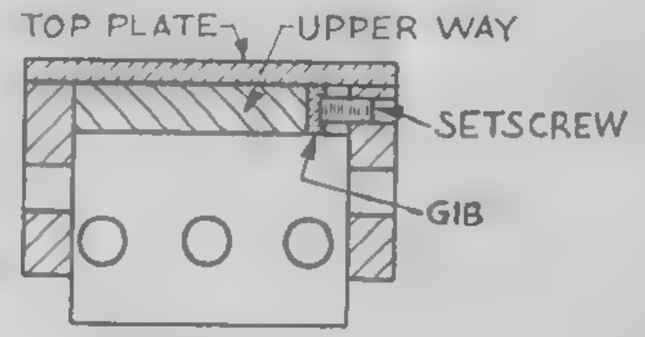
CLAMP-UP "B"



5

CARRIAGE ASSEMBLY

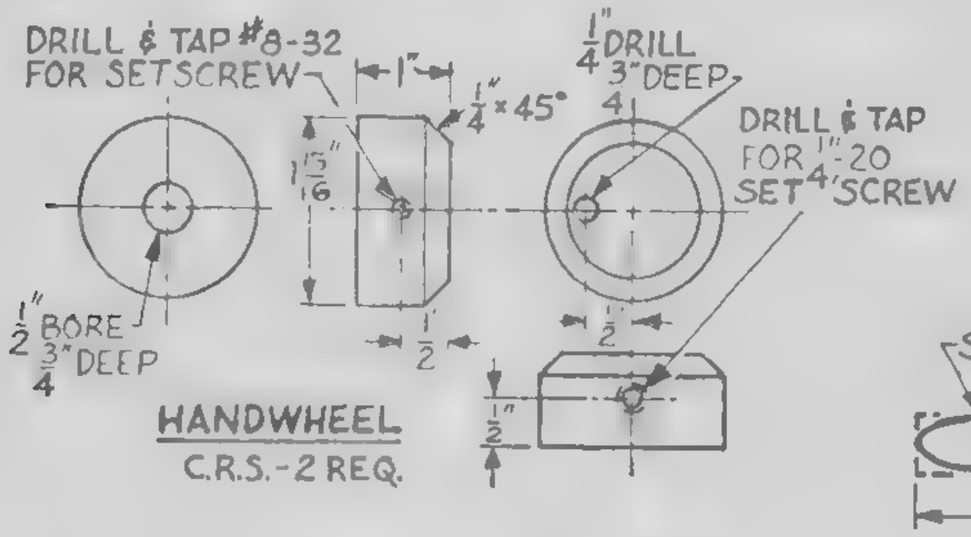
NOTE: OPPOSITE PLATES MUST BE PARALLEL, ADJACENT PLATES 90° TO EACH OTHER.



A

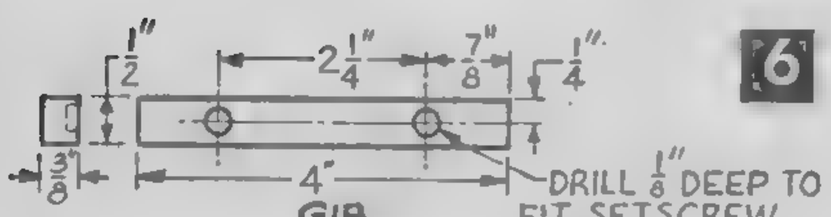
CARRIAGE

NOTE OFFSET OF WAY & CARRIAGE. OFFSET OF LOWER WAY SIMILAR.



HANDWHEEL

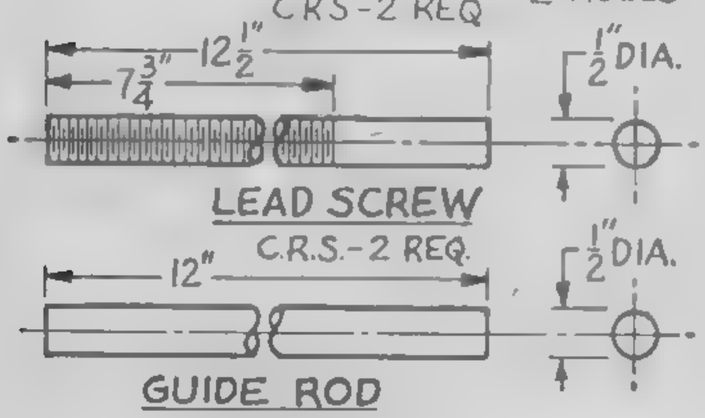
C.R.S.-2 REQ.



6

GIB

C.R.S-2 REQ

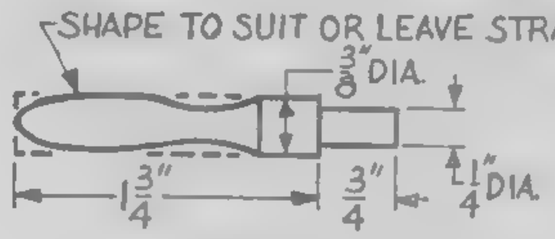


LEAD SCREW

C.R.S.-2 REQ.

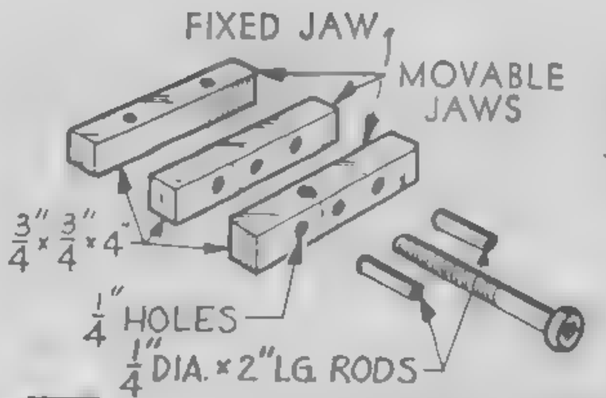
GUIDE ROD

C.R.S.-4 REQ.

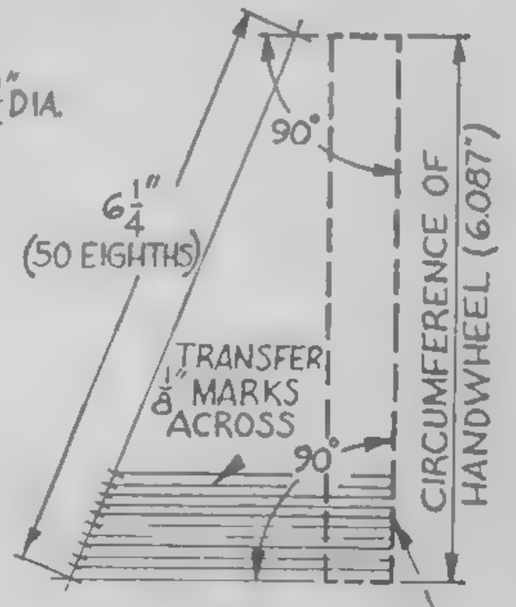


HANDLE

C.R.S.-2 REQ.



7 **VISE,** SUGGESTED DESIGN



8

ish the ends. The spinning handles (Fig. 6) can be machined as shown, or can be left straight with the ends filed round in the drill press. Secure the handles solidly in the handwheels with 8-32 set screws (Fig. 6).

To calibrate the handwheels, measure their exact circumference (this will be 6.087-in. if the blank is $1\frac{15}{16}$-in. diameter) with a strip of paper and make a drawing with this dimension divided into fifty equal parts by laying out fifty eighths-of-an-inch (6¼ in.) between two lines drawn 90° to the handwheel circumference line (Fig. 8). Transfer the eighth-inch marks across, then cut a strip out of the layout, and wrap this around the handwheel, holding it with scotch tape. With a sharp cold-chisel, cut ⅛-in. long graduation marks into the edge of the handwheel. Make every 5th and 10th graduation ¼-in. long, and identify every 10th graduation with the proper number stamp (0, 10, 20, etc.). Each graduation will represent 1/1000th-in.

Complete the assembly of your compound table by installing the lead screws, with their handwheels and retaining collars, and by attaching the vise parts on the top plate.

Although specially designed to fit at the foot of the average bed, this dressing bench can be placed anywhere in the nursery or bedroom. All sharp edges at the top have been rounded off.

Child's Dressing Bench

BRIGHTLY colored animals in a cage will help to remind small children that everything has a place and should be kept there. While hanging garments on the dowel rack or arranging their shoes neatly in the open left end of the bench, they will have fun identifying the black panda, yellow giraffe, orange monkey, blue seal and a cherubic red elephant. A drawer is provided on the left end for socks, underwear and other small clothing or accessories (Fig. 1B); a shelf on the right side holds shoes (Fig. 1A).

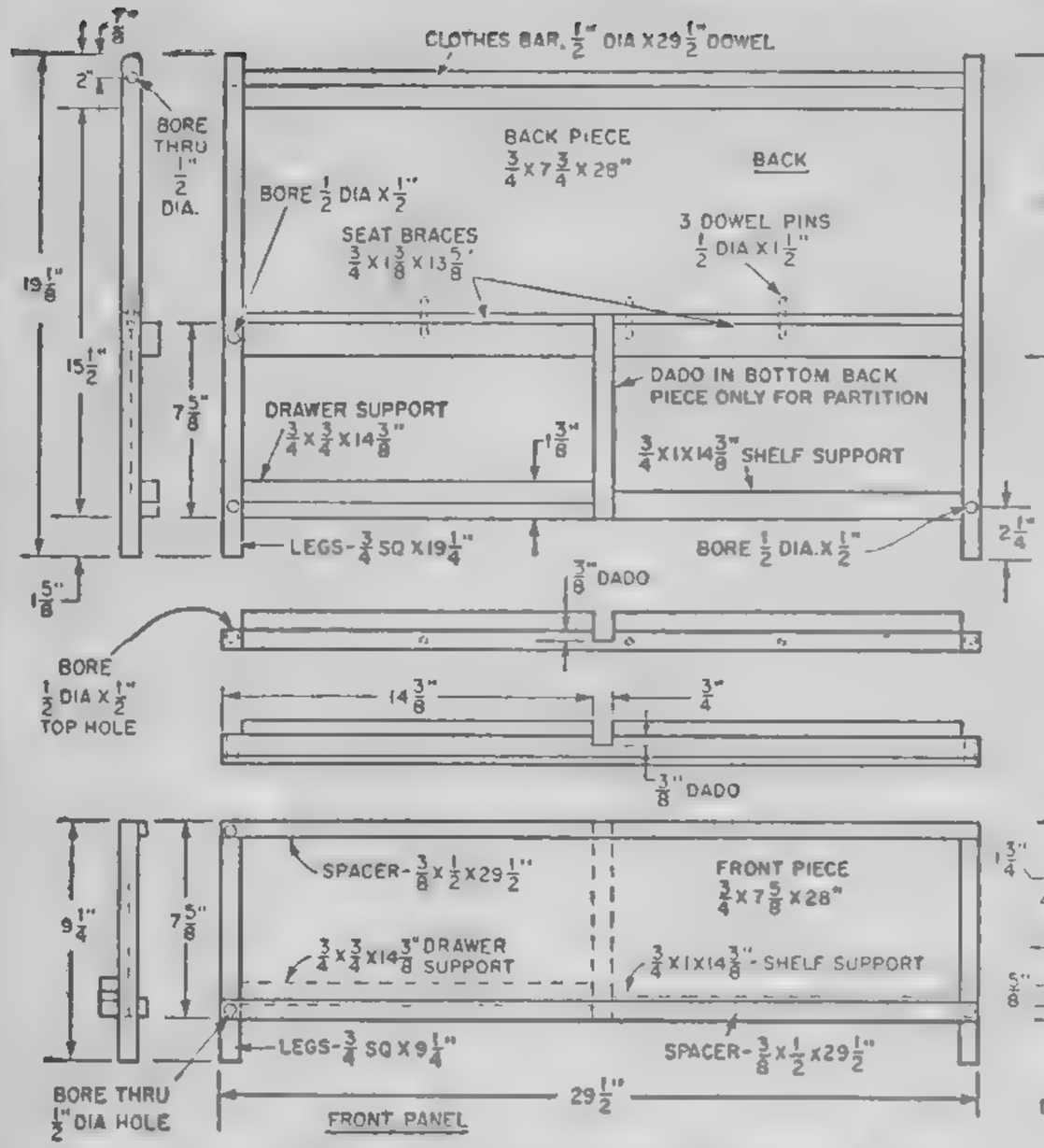
Construction. First make the back panel which consists of two ¾ x 7¾ x 28-in. pieces (Fig. 2). Cut a ⅜-in. deep x ¾-in. wide dado in the lower back piece to receive the partition. In a long end of each board bore three ½-in. dia. holes ¾ in. deep to match, then dowel and glue the back pieces together.

Cut two 9¼-in. long front legs and two 19⅛-in. long back legs, rounding off the tops of the back legs. Bore ½-in. dia. holes through the top end of both back legs and glue in place the ½-in. dia. x 29½-in. maple dowel which serves as a clothes bar. Bore ½-in. dia. x ½-in. deep holes 2¼ in. from the bottom of all four legs to receive the lower end braces. Also bore a ½-in. dia. x ½-in. deep hole 6⁷⁄₁₆ in. above the previous holes on the left legs only, to take the upper end brace.

Nail the 19⅛-in. legs to the back panel, using 1½-in. finishing nails. Glue and nail or screw the two seat braces in place on the back panel. Then in like manner, fasten the drawer support on the right side of the bench.

To build the front panel, first cut a ⅜-in. deep x ¾-in. wide dado for the partition in the front piece. Then secure the 9¼-in. legs to the ends of the front piece. Now fasten the drawer support and the shelf support to the front panel, lining them up carefully with the corresponding parts on the back. Nail two spacer strips along the top and bottom edges of the outside of the front panel; these will serve to hold the cage front out far enough to clear the animals.

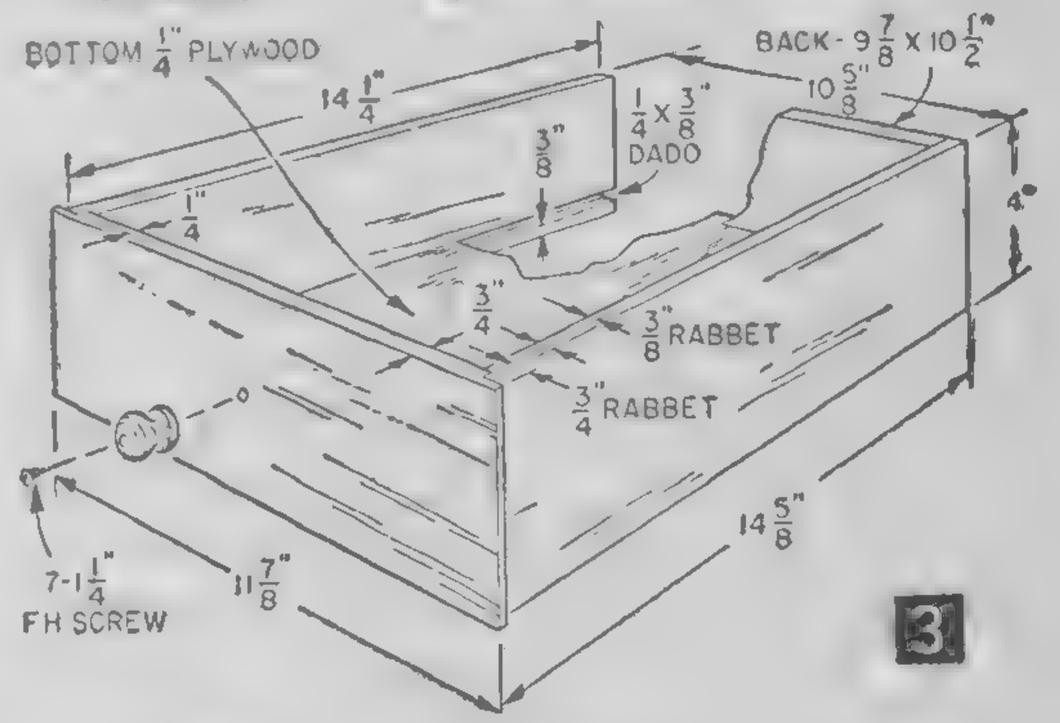
To build the seat, fasten the ¾-in. sq. x 11½-in. stiffeners along each end to prevent warping. Next, saw the partition, shelf, and three end braces to size. Bore ½-in. dia. holes ½-in. deep in each end of each brace; insert and glue ½-in. dia. x 1-in. dowel pins.



2

Now construct the cage front, using 5 ply plywood for the ends, and ¾-in. square stock for the top and bottom strips. Lap joint all pieces for strength.

Using a pair of dividers, lay out the spacing for 14 dowel bars and drill 3/16-in. dia. holes ⅜ in. deep in top and bottom strips. Cut 12 dowels for cage bars 6⅞ in. long and two bars 4¼ in. long, and set them in the holes. Then put the end pieces in place and glue the joints. When the glue is dry, place a #6 x 1¼-in. *fh* screw in each corner for strength. Plane and sand a radius of about ¼ in. on the top corners to relieve the sharp corner, as this becomes the seat edge.

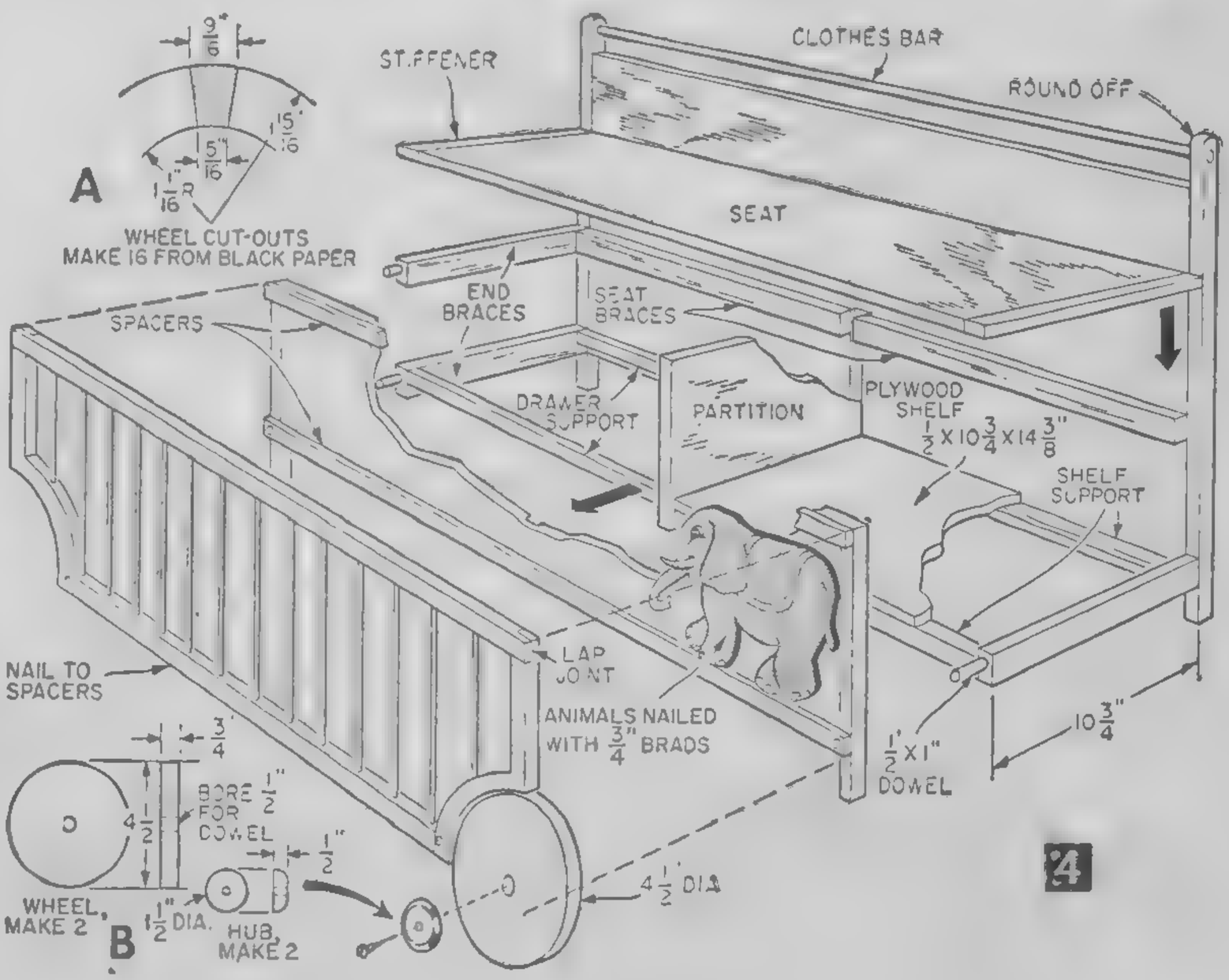


3

Cut out the wooden wheels (Fig. 4B) on a jigsaw; since they do not turn they need not be perfectly true. Turn the wooden hubs, or use wooden buttons. Use two pieces of ½-in. dia. dowel 1⅛ in. long as the axles and attach the hubs to the axles with #4 *fh* screws.

Build the drawer as shown (Fig. 3), and attach a turned wooden knob to the front with a #7 x 1¼-in. *fh* screw, or use a commercial drawer pull.

Next, jigsaw the animals (Fig. 5), after enlarging the patterns and tracing on ¼-in. plywood. Sandpaper



4

the edges.

Assembly. First make a trial assembly of the dressing bench (Fig. 4) to check the fit of the various parts—don't glue or nail as yet. Start by placing the three end braces in the holes provided for the dowels on the back panel. Then bring the front panel into position and slide the other ends of the braces into place. Slide the partition up into the dado cut at the middle of both panels. Place the seat in position. Insert the stub axles in front and slide the wheels on.

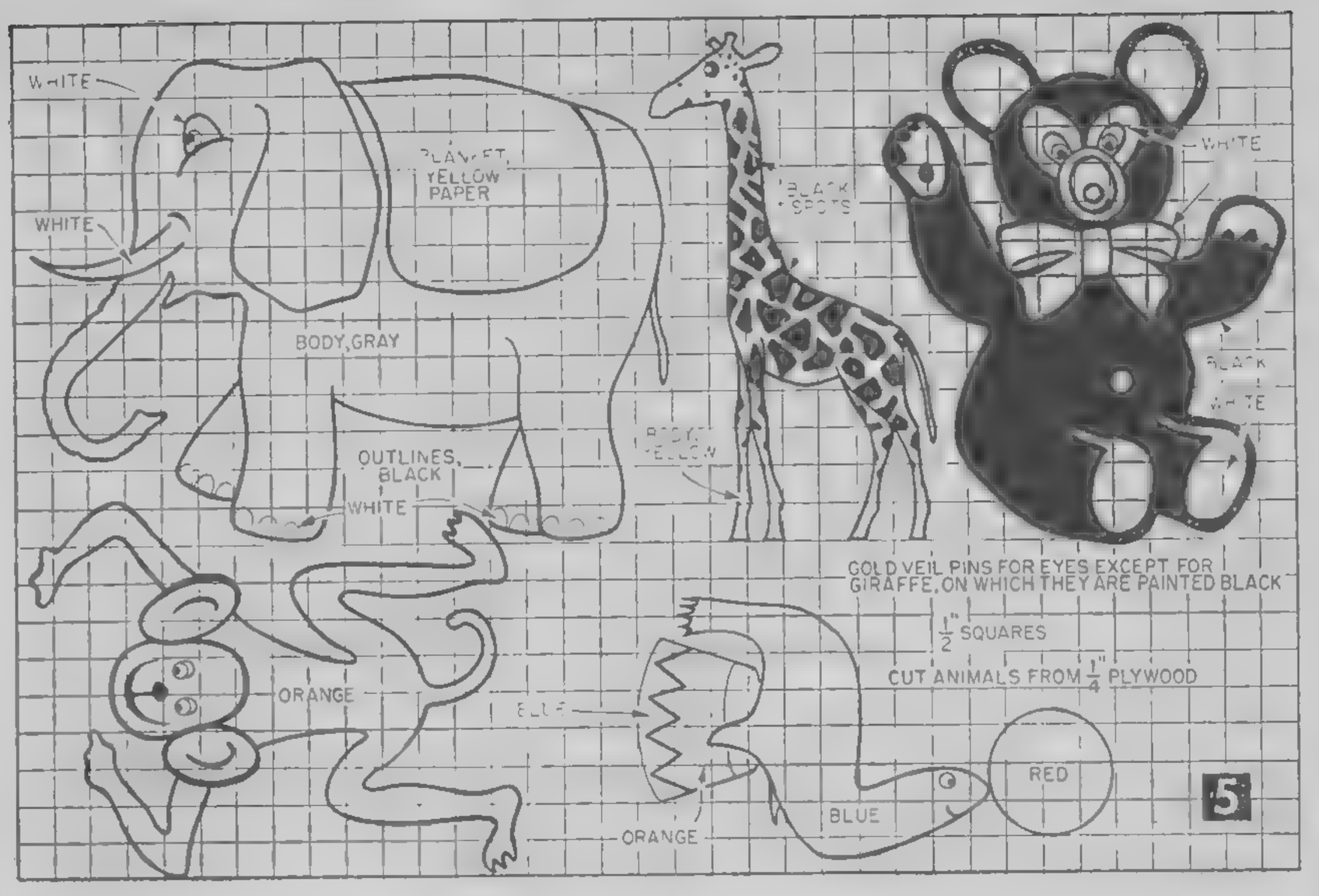
Now arrange the animals on the front, but do not attach them. You will have to cut off the rear foot of the elephant and part of the bear in order to space the animals as shown, but this is covered by the cage front. Place the cage front over the animals.

Try the drawer and shelf in their respective positions. Now take down the trial assembly and make the final assembly with glue and 1½ in. finishing nails. Leave the animals and cage front off until painting is completed.

Painting and Decorating. Brush on two coats of gray undercoat and sand with #1-0 paper. Then paint the bench and cage front with two coats of white porch enamel. Paint front and inside only of drawer; leave edges and sides unfinished. Brush two coats of *Testor's Sanding Sealer* on the animals and sand after second coat with #400 paper. Then give each animal three coats of colored *Testor's STA Dope* (model airplane paint) as indicated.

Apply the black lines around the monkey's face and on the elephant with a fine brush. Cut out paper parts for the panda and elephant and cement in place. Paint on the giraffe's eyes. The eyes on the other animals are 3/16-in. dia. gold veil-pin heads with a black pupil painted on each eye. By careful placing of the eyes and cheeks, you can make the animals seem to smile and look out at you.

Nail the animals on the bench front with 3/4-in. brads. Paint the bars of the cage front black, gold or any color you desire and nail the cage front over the animals. Make the 16 wheel cutouts from black paper and glue eight to each wheel. (Note: All paper parts can be painted instead, if you prefer.) You will find decals to decorate the seat back at your local paint or hardware store. We used a deer, cub, clown and lion to carry out the circus motif. If you are making the dressing bench for a little boy, cowboy and Indian decals can be substituted for the ones shown.



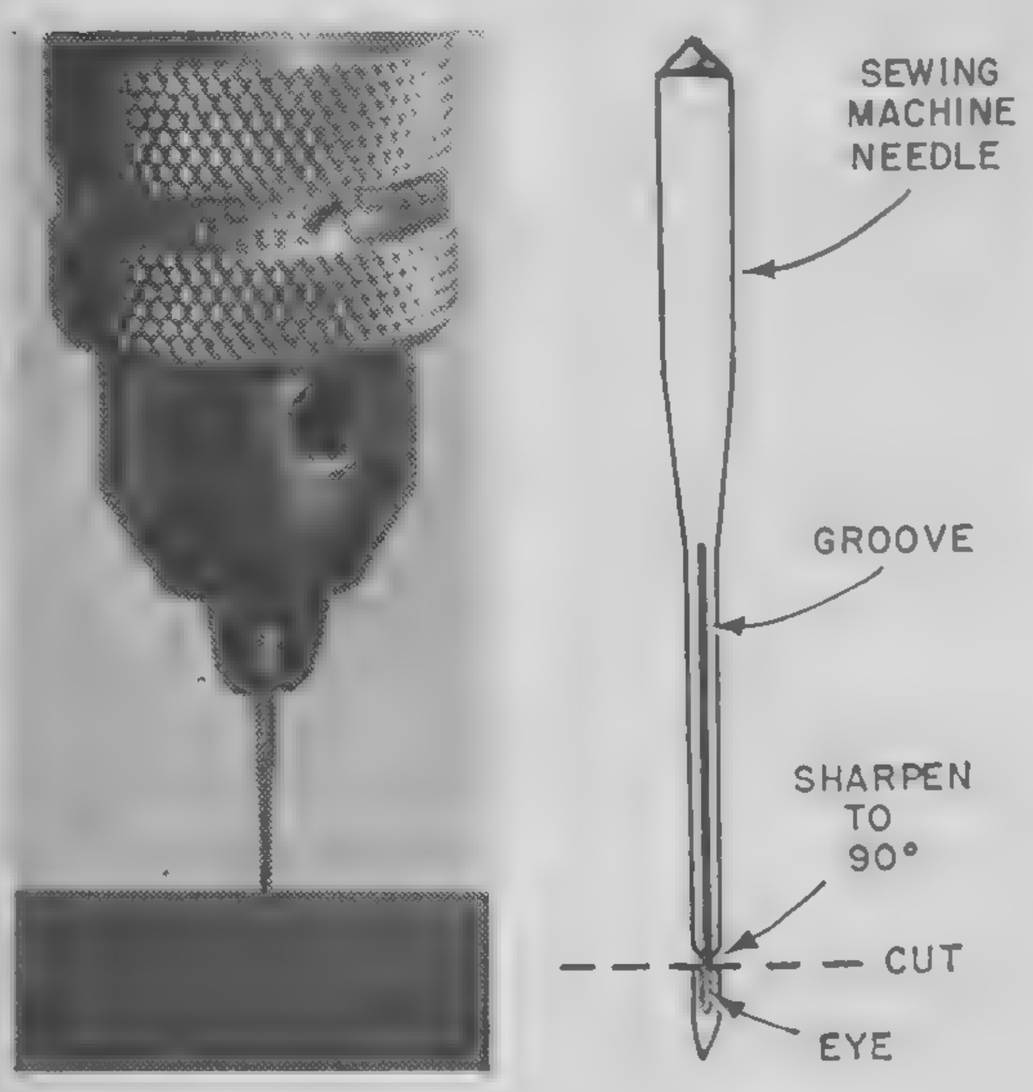
MATERIALS LIST—CHILD'S DRESSING BENCH

All Dimensions in Inches

No. Reqd.	Description	Use
Pine		
2	3/4 x 7 3/4 x 28	back
1	3/4 x 7 5/8 x 28	front
1	3/4 x 12 1/2 x 28	seat
2	3/4 x 3/4 x 19 1/8	back legs
2	3/4 x 3/4 x 9 1/4	front legs
2	3/4 x 1 3/8 x 13 5/8	seat braces
2	3/4 x 3/4 x 13 5/8	drawer support
2	3/4 x 1 x 13 5/8	shelf support
2	3/4 x 3/4 x 11 1/2	seat stiffener
1	3/4 x 7 3/4 x 11 1/2	partition
3	3/4 x 1 3/8 x 10 3/4	end braces
1	3/4 x 3/4 x 29 1/2	cage top edge
1	3/4 x 3/4 x 24 3/16	cage bottom edge
2	3/8 x 1/2 x 29 1/2	cage spacers
2	3/4 x 4 1/2 dia.	wheels
2	1/2 x 1 1/2 dia.	hubs
1	3/4 x 3 3/8 x 9 1/8	drawer back
1	3/4 x 4 x 11 3/8	drawer front
2	3/4 x 4 x 14 1/4	drawer sides
Plywood		
1	1/4 x 9 7/8 x 13 1/2	drawer bottom
2	3/4 x 3 3/8 x 7 5/8	cage ends
1	1/2 x 10 3/4 x 14 3/8	shelf
1	1/4 x 7 x 24	animals
Maple Dowels		
3	1/2 dia. x 1 1/2	back assembly
1	1/2 dia. x 29 1/2	clothes bar
12	3/16 dia. x 6 7/8	cage bars
2	3/16 dia. x 4 1/4	cage bars
2	1/2 dia. x 1 1/8	axles
6	1/2 dia. x 1	brace assembly
Miscellaneous		
6	3/16 dia. gold veil pins	animal eyes
1 pt.	gray undercoat	
1 pt.	white porch enamel	
1	2 oz. Testor's Sanding Sealer	
5	2 oz. Testor's STA Dope (1 each yellow, blue, black, red, orange)	
	Decals, white and black construction paper, screws, brads and finishing nails as specified	

Pilot Drill For Brads

• When setting small brads in hardwood or through light metal such as key plates, drill the pilot hole with a reground sewing machine needle held in a pin vise or a hand drill. Grind the tip of the needle up to the eye and sharpen it as you would a twist drill. If the tip is accurately sharpened, you can pierce up to 1/16-in. aluminum.—Robert Micals.



Peg Board Tape Dispenser

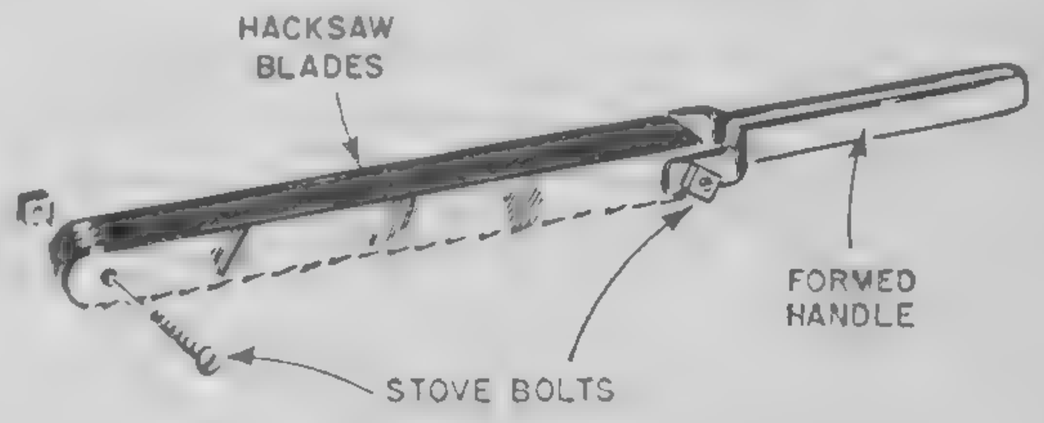
• A couple of stove bolts, a metal reinforcing plate, and a pair of wing nuts are all you need to mount your plastic tape dispenser on a peg board panel. Fasten the bolts permanently to the board and then mount the dispenser with the metal plate to make it easy to remove for refilling.

Readable Reference Marks

• Keep those often-used marks on your saw table and other machines from being rubbed off or made illegible by covering them with a strip of cellophane tape. A set of these marks at 6-in. or 1-ft. intervals along your saw fence can save time when roughing out work.

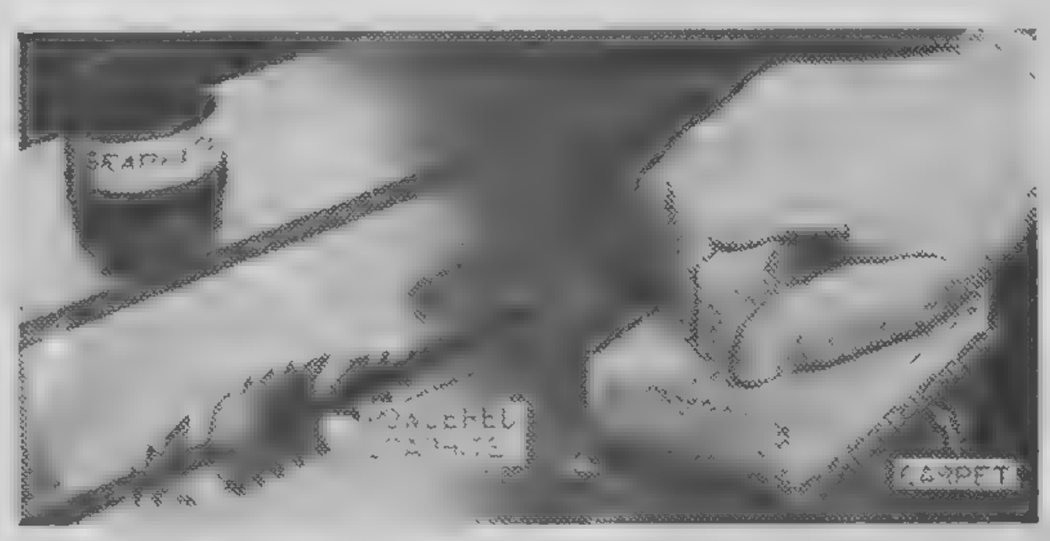
Hack Saw Blade Wood Rasp

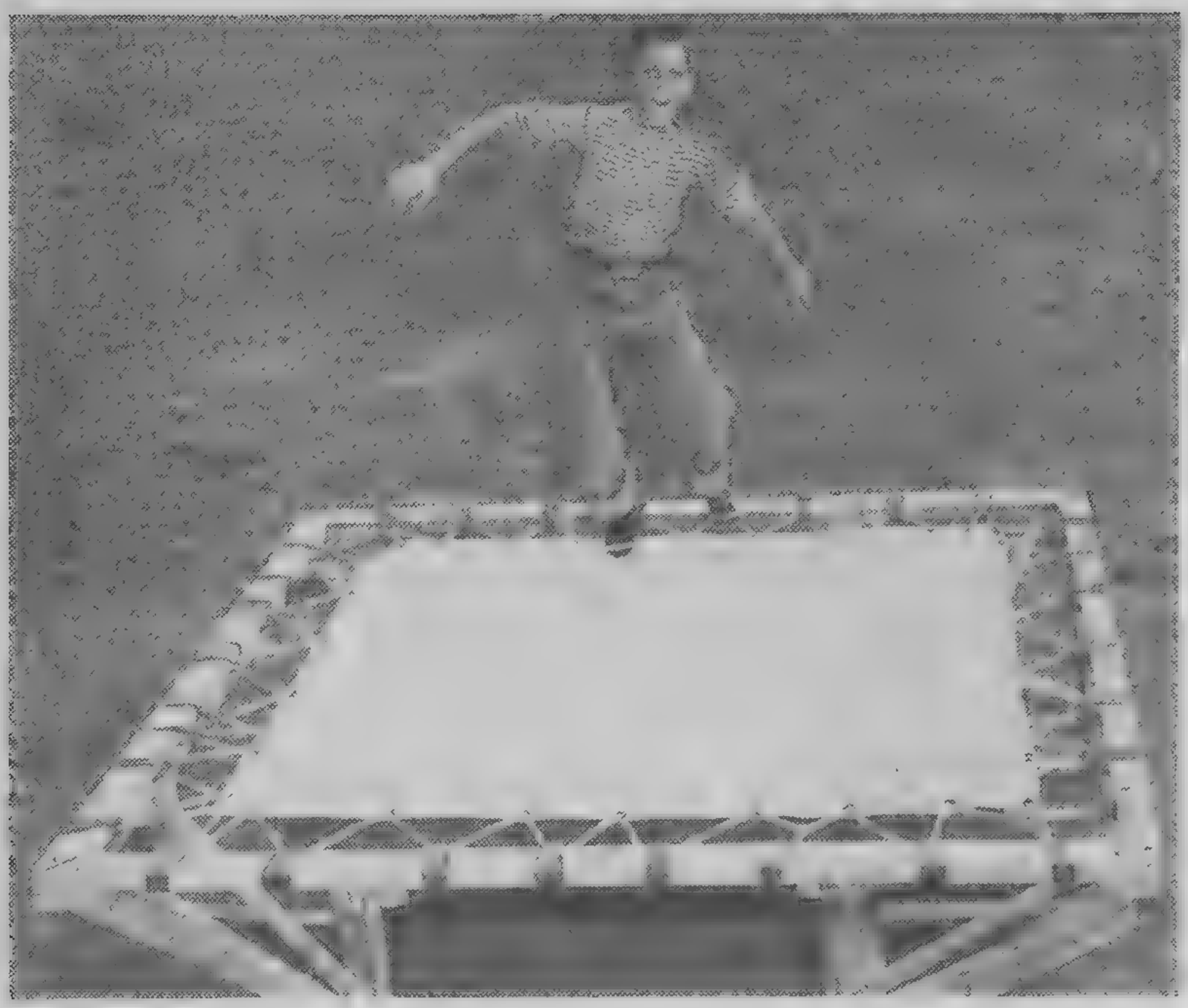
• Put those worn hacksaw blades to use by bolting several of them together as an improvised wood rasp. Be sure the teeth are all facing in the direction of cut and then bend a piece of light strap iron to form a handle on the other end.—G. E. Hendrickson.



Graphite Guard

• Instead of oiling polished steel surfaces, try giving them a moisture-proof coating of finely powdered graphite. Go over the rusted spots with coarse steel wool and finish them with emery cloth. Sprinkle the graphite powder on generously and rub it well into the surface with a piece of carpet glued to a block of wood.—Bil Toman.





Youngster enjoying trampoline bouncing on simple backyard bouncer. This design proved sturdy when bounce tested by a 170-pound man.

Backyard Bouncer For Less Than $20

By R. G. PUCKETT

Instead of having my youngsters continue to pay 50¢ an hour to use a trampoline at a local bounceland center, I built them this simple version for under $20.

I tested it for strength, safety and durability by jumping on it myself, and I weigh 170 lbs. The bounce is provided by 38 "rubber bands" cut from discarded automobile inner tubes. Since these can be picked up for free at your local garage or gas station, your maintenance cost will be zero.

The Trampoline Bed is the only part that you probably cannot make yourself because a heavy duty sewing machine is required. We had ours made up complete at a local awning shop for $10. Tear out this article and bring it to the shop that is going to make the bed for your trampoline, so they can follow the dimensions in Fig. 1. Tell them to use at least 15-oz. canvas. If they can sew it with the ⅜-in. sash cord in the hem around the outer edges (Fig. 1A), it will save you the trouble of pulling the cord through with a wire.

Frame Rails should be made of clear, straight fir 2 by 4's. Cut two of the rails 92 inches long and two 80 inches long, mitering the ends at 45 degrees. Round off the long corners with a plane and sand smoothly. Next cut four triangular pieces from 2 x 6 in. stock (Fig. 1B) to join the ends of the rails. Place the rails on top of the triangular blocks and lay out and drill four 9/32-in. holes for the ¼-in. carriage bolts. Be sure to space these holes 1¼ and 2¼-in. from the miter cut edge to provide clearance for the 2 x 4-in. leg brace which will be located under the blocks. Then bolt the rails together, placing the bolt heads on top.

Frame Legs consist of four sets, each having two legs. Make these as in Fig. 1C, bolting all of the parts together except the 1 x 2-in. braces which can be nailed. Rip the 1-in. thick tie bars from scrap 2 x 4-in. stock and bolt them to the top ends of the legs. Then turn the frame rail assembly upside down and place the four sets of legs, also upside down, at the corners. Mark the drilled hole locations through the tie blocks (Fig. 1D) on the rails with a big nail and drill

MATERIALS LIST—BACKYARD BOUNCER

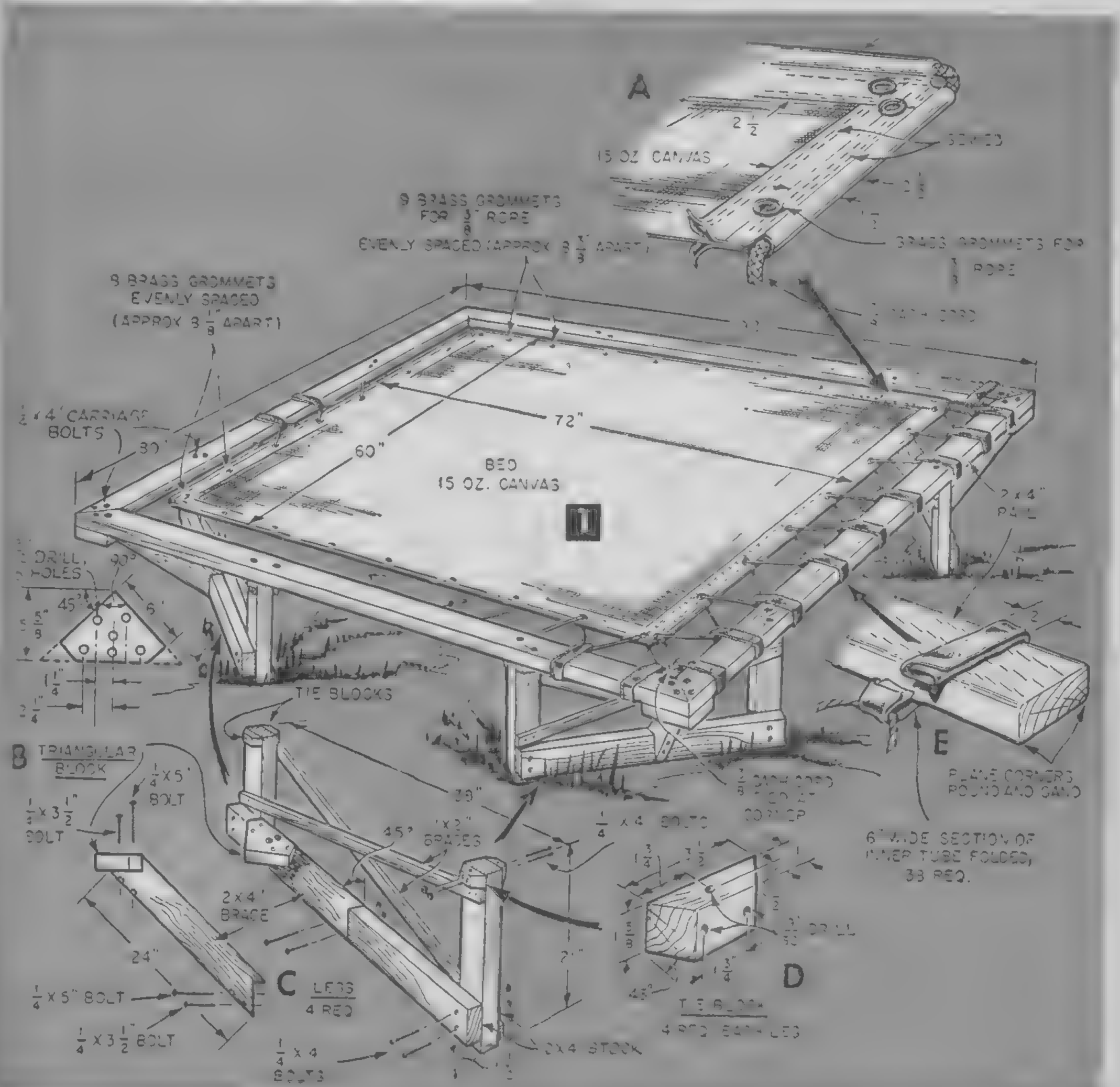
No. Req.	Size and Description	Use
4	2 x 4" x 8' clear straight grained fir	rails
4	2 x 4" x 10' fir or hemlock	legs
4	1 x 2" x 8' fir	leg braces
1	2 x 6" x 4' fir or hemlock	triangular blocks
1	60 x 72" trampoline bed (have local awning shop make this up from 15 oz. or heavier canvas)	
75 ft.	⅜" sash cord	bed
64	¼ x 4" carriage bolts with nuts and washers	
8	¼ x 5" carriage bolts with nuts and washers	
8	¼ x 3½" carriage bolts with nuts and washers	

two 9/32-in. holes through the 2 x 4-in. brace and into the triangular blocks. Now remove the four bolts that hold the blocks on the rails and bolt the blocks to the leg assemblies. Have the bolt heads on the tops of the blocks, otherwise the nuts would interfere with replacing the rails. For a finish, give the rail and leg assemblies one coat of primer followed by a coat of exterior enamel.

Assembling the Trampoline. Cut 38 sections, each 6-in. long, from car inner tubes. Use the same size inner tubes for all sections so that the elasticity of each will be the same. Slide nine of the sections on each of the short rails and ten on the long rails. Then bolt the rails to the leg assemblies arranging the carriage bolts so that the round leads are on top, and the nuts and washers underneath. Space the inner-tube sections so that three of them are between the leg assemblies on the short (80-in.) rails and four of them are between the leg assemblies on the 92-in. rails.

Now fold the ends of each inner-tube section, making a 2-in. wide band as in Fig. 1E. If needed, a dab of rubber cement will keep them folded. To install the bed, turn the frame upside down and place the bed in the center. Then lace the bed to the inner tubes with 3/8-in. sash cord as in Fig. 1. Use four lengths of cord, one for each side, and tie them together at the corners.

Now turn your trampoline right side up and let your youngsters have the time of their lives. If your youngsters are quite young and small they may not have enough weight to get a good bounce. If such is the case you can cut one of the folds off each inner-tube section to reduce the stiffness. Be careful, however, not to reduce the size of the inner-tube sections to the point where there is danger of a youngster striking the ground at the bottom of the bounce.

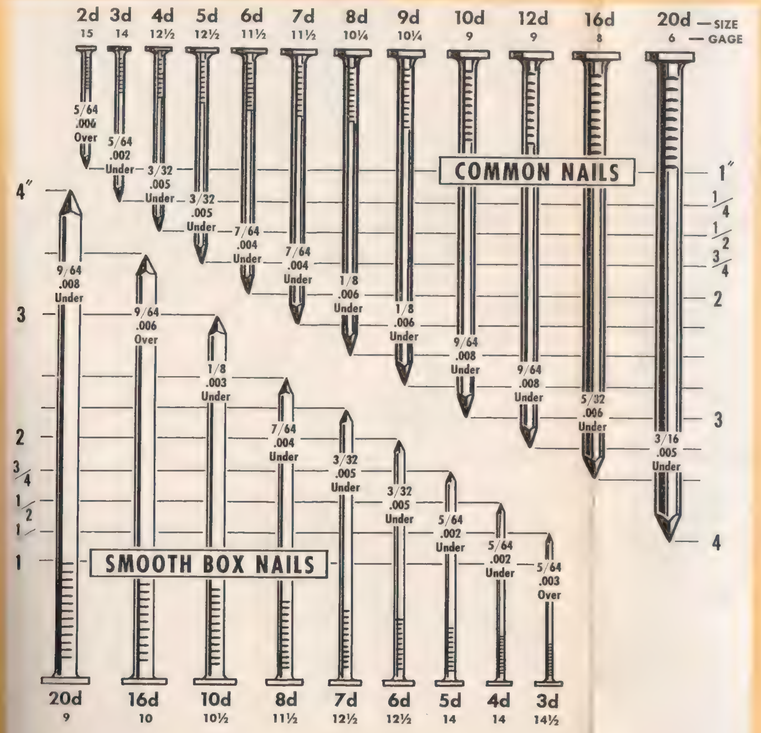


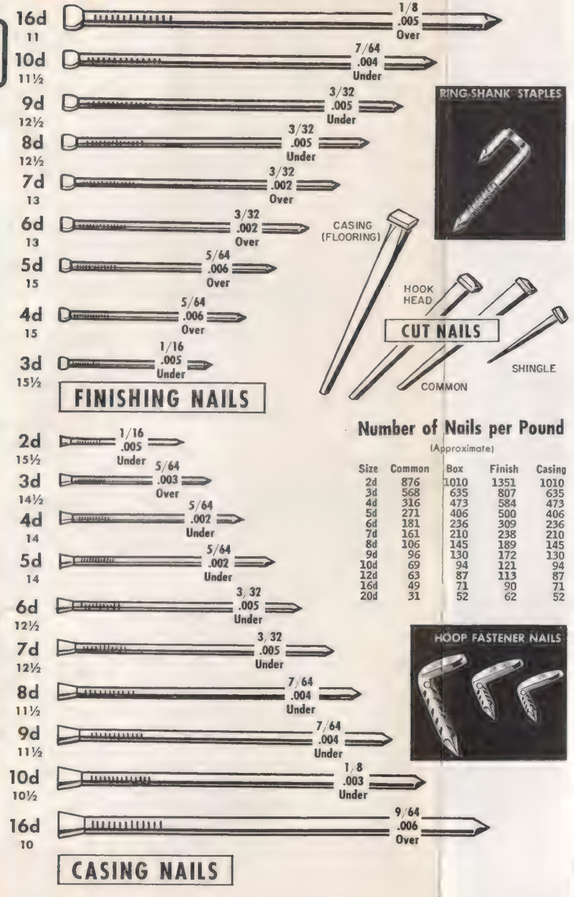
B-1023 Nail Selector Wall Chart for Your Shop

EXACT reproductions of steel wire nails in these four main categories will make identification easy and guide you in choosing the right nail for the job at hand.

The so-called common nail with flat, projecting head is still the universal standard throughout wood frame construction. Box nails, similarly shaped but slightly thinner, are preferred for box-making, also in many siding applications and some lighter framing work.

SCIENCE and MECHANICS





Number of Nails per Pound

(Approximate)

Size	Common	Box	Finish	Casing
2d	876	1010	1351	1010
3d	568	635	807	635
4d	316	473	584	473
5d	271	406	500	406
6d	181	236	309	236
7d	161	210	238	210
8d	106	145	189	145
9d	96	130	172	130
10d	69	94	121	94
12d	63	87	113	87
16d	49	71	90	71
20d	31	52	62	52

Finishing and casing nails are the answer when you need to nail through exposed wood surfaces but do not want the nailheads to show.

Finishing nails, with small heads only slightly larger than their thin shanks, are easily "set" (recessed in the wood) with a nailset, making them ideal for fine cabinetry, moldings and trim where great holding power is not the main consideration. Casing nails, similar but having slightly larger, countersunk heads and shanks comparable to box nails, are substituted where holding power is wanted as well as finishing nail qualities. They are favored for door and window casings, also floor installations.

After determining the type nail you wish to use, check the chart for the right size. The term "penny", denoted by "*d*", indicates length while diameter is shown by the wire gage number. All nails 2 in. long, for example, are called sixpenny nails, regardless of type or diameter. Nail lengths from 2*d* to 20*d* are given. Few home craftsmen will use a larger size.

In general, when nailing one board or piece of framing lumber to another, nails should be three times the thickness of the piece when handling softwood. Twice as long will do for hardwood, or when using threaded nails.

Where there's danger of splitting wood or bending nails, drill shank holes to nearest 64th in. diameter for most of the nail's length. Correct drill size for each nail is given in the chart, along with the amount each hole will be over or undersized.

NAIL POINTS

Basic Types and Use

DIAMOND

Diamond Points, the most commonly used type, are adapted for general use. Both the regular and long diamond points are easily driven and can be satisfactorily used in all wood.

CHISEL

Chisel Points are used on larger nails for hard woods. The sharp chisel point cuts the wood fibers rather than setting up strains

SIDE

Side Points are designed for woods that split easily and for clinching.

NEEDLE

Needle Points are used widely in box making. This point is designed for fast nail handling and penetrates easily.

BLUNT

Blunt Points cut the wood fibers rather than forcing them apart—thus eliminating strains that cause splitting and lessen holding power.

DUCK BILL

Duck Bill Points are used primarily on the smaller nails for clinching and veneering. The driving ease and holding power are similar to the Chisel Point.

Added Holding Power with Threaded Nails

Development of threaded nails over the past two decades has revolutionized fastening methods. Their annular, spiral or screw shanks give at least twice the holding power of smooth nails since the threads are shaped to let nails be driven in easily and to resist tenaciously, like fishhooks, any movement in the opposite direction.

Wood that tends to pull away from nails as it seasons is merely drawn up tighter as the wood fibers remain wedged in the deep grooves of the nails. This puts a virtual stop to gypsum board nail-popping, squeaking floorboards and loose shingles.

Because a grooved shank weighs less than a smooth one of similar size, the thinner threaded nail drives easier and cuts fewer than other types. You can space them close together, or drive them nearer an edge or end with less likelihood of splitting the wood. They will go through many hardwoods without pre-drilling. While per-pound cost is higher, the number of nails per pound is greater. Where holding power will permit a smaller size nail, the per-nail cost may be less for the job.

The spiral nail, most common of the threaded varieties, turns as you drive it home. Resulting grooves in the wood are especially effective in hardwood. Annular ring nails are most efficient when used with softwoods. The screw type combines the other two, and offers a much tighter spiral for still greater holding power. A knurled thread is applied to hardened steel nails for fastening to masonry.

Virtually every nail now has a threaded counterpart in any length; many are pictured on both sides of this chart. In addition to regular or hardened steel, some are made of copper, brass, bronze, silicon bronze, aluminum, zinc or Monel (a rustproof nickel-copper alloy). They may be had in plain, galvanized or electroplated finishes, as well as baked-on lacquer in colors.

On the Reverse Side:

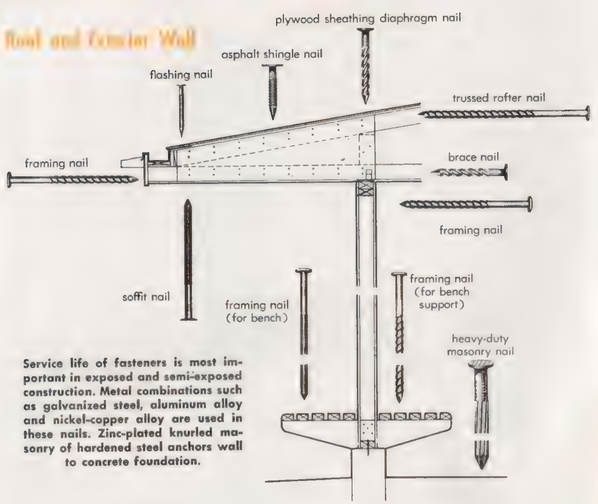
How to use a hammer, toenail, set or clinch nails, nail mitered joints, make hidden nail joints, plus several threaded nail applications.

Annular-thread nails above are (from left): underlay floor type with flat countersunk head and blunt joint; gypsumboard type with flat head and long diamond point; common nail, flat head medium diamond point.

Comparing results when 10d common nails are driven in wood. Plain-shank nail at upper left cut fibers cleanly, while spiral type (lower left) wrapped up many in its grooves. Fibers imbed annular nail below.

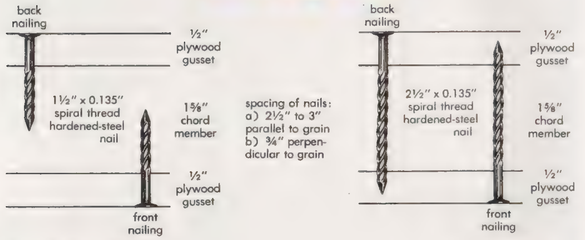
THREADED NAIL APPLICATIONS

Roof and Exterior Wall



Service life of fasteners is most important in exposed and semi-exposed construction. Metal combinations such as galvanized steel, aluminum alloy and nickel-copper alloy are used in these nails. Zinc-plated knurled masonry of hardened steel anchors wall to concrete foundation.

Section through Truss

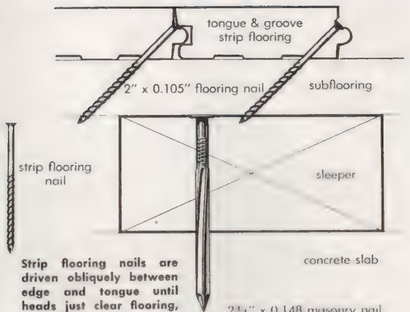


NAILS IN SINGLE SHEAR requiring twice as many nails as in double shear

NAILS IN DOUBLE SHEAR with alternate nails driven from front and back

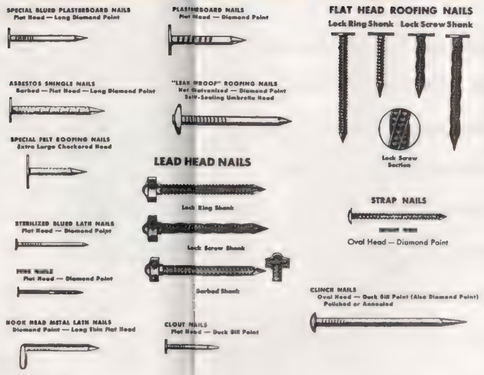
Galvanized steel, spiral-thread nails are commonly used where great stresses may occur.

Flooring



Strip flooring nails are driven obliquely between edge and tongue until heads just clear flooring, then are driven down to the tongue with a nail-set to complete a hidden joint. Masonry nails fasten sleeper to slab.

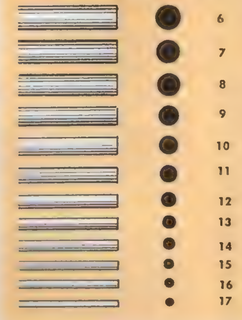
Miscellaneous Special Purpose Nails



Wire Gage Numbers

(Actual Size)

Hold any nail or screw against this chart to check for nearest wire gage diameter.



NAILING TIPS

The face of your hammer is slightly rounded to help you drive a nail straight. Grip hammer near the handle end and start the nail with a light tap, squarely on the head. Increase power of your blows gradually as the nail sinks into the wood. Fewer fibers will be broken and you'll have greater holding power.

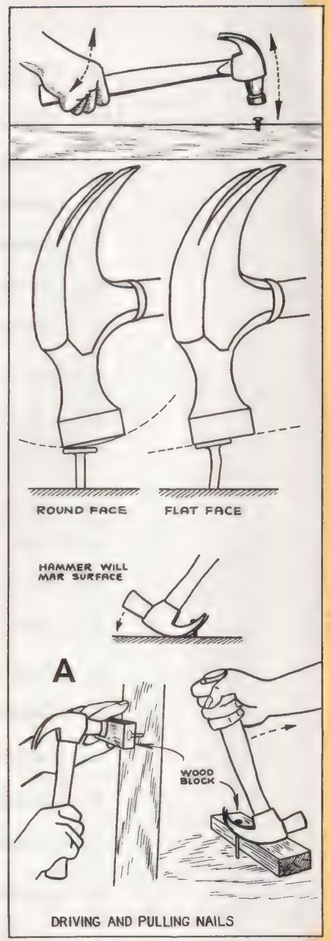
Save the Surface. If you bend a nail, pull it out and start a new one. To avoid marring the surface when pulling a nail, first place a block of wood under the head of the hammer (A at right). This will not only save the work, but give you more leverage to pull the nail. The block can also be used to finish driving a nail flush with a surface and avoid hammer marks. Where danger of splitting exists, drill a lead hole about 1/32-in. less than nail diameter; more for larger nails. If a lubricant is needed, use paraffin or wax; a corrosive in soap tends to rust and thus leads to staining.

Hiding the Head. Where nails are to be completely concealed, such as with finishing or casing nails in fine work, drive them to about ⅛-in. from the surface, then apply a nail set (B) to finish the job. Set the nails about ⅛ in. below the surface (H), just enough for putty or plastic compound to take hold.

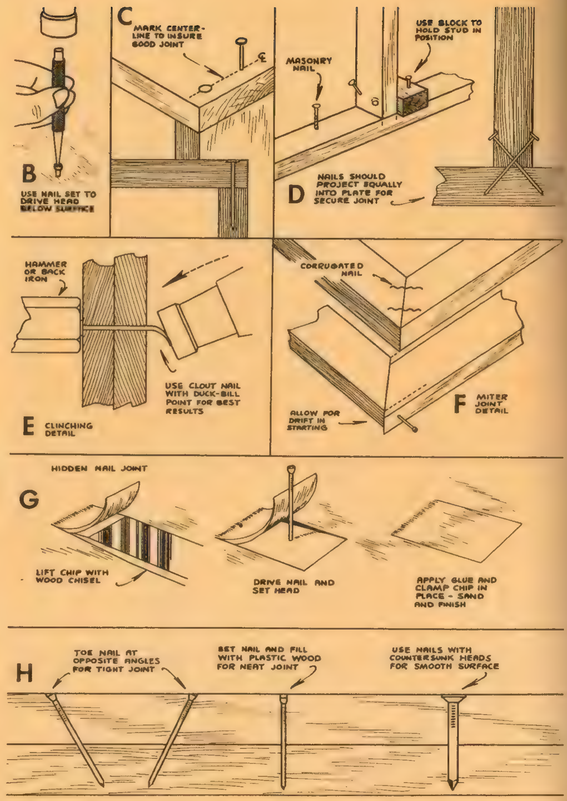
Blind Nail Joint. Lift a shaving about halfway (G), using a chisel, bevel side up. Do this carefully to avoid breaking off the loose piece. Drive the nail in the exposed wood and set it below the surface. Now glue the shaving, clamp it back in place and sand the area well after glue has dried. The joint will then be invisible.

Toenailing Wall Studs to a plate or sleeper will be easier if you nail a block of wood temporarily alongside of the stud position (D). This will keep the stud from drifting off the mark while nailing. Be sure that nails engage equal parts of each piece of wood and avoid nailing at too acute an angle.

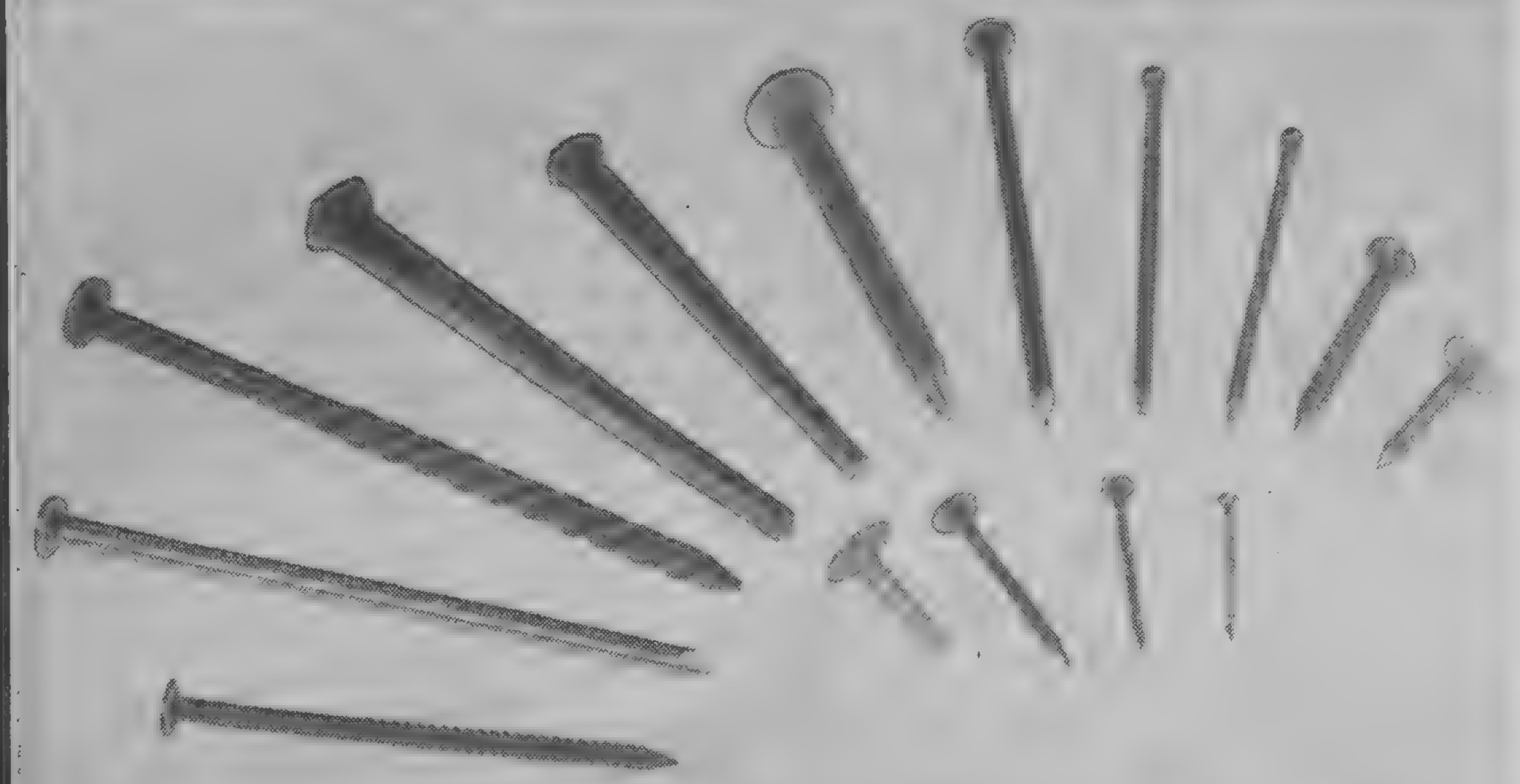
Clinching is easily done by following a few simple rules. First, use nails designed for the job, such as cleating, side-pointed, or duckbill-pointed nails. Drive nail through the material and against a backing iron (E) or the head of another hammer to turn point of the nail. Then hold the iron against the nailhead and bend the point back into the wood with a few light hammer strokes.



DRIVING AND PULLING NAILS



Bonus Wall Chart



Your Guide to Nails

Know how to identify and use them. Pick the right type for every job with this bonus wall chart

By ED HAMILTON

DO YOU know one nail from another or are they all alike except, maybe, in length?

Your own home, if it's a typical frame structure, is probably held together by at least 67,000 nails ranging from tiny tacks to stout spikes. And the newer the house, the more variety you'll find in its nail fastenings whenever you enlarge, modernize or repair it.

But whether a nail neophyte or know-all, you'll find the free full-size selector chart at the right a valuable addition to your how-to files. Mounted on your home workshop wall, it's a ready reference every time you pick up your hammer. Actual size reproductions of nails most often used, wire gage diameters and drill sizes to the nearest 64th of an inch will help you select the right nail to use.

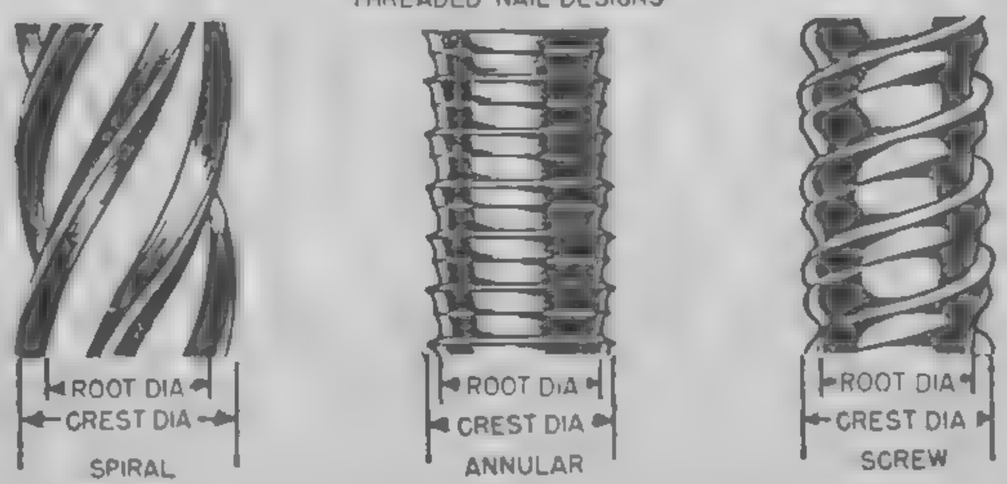
There's a special section on the recently developed threaded nails, which are rapidly gaining in popularity.

The foldout chart also discloses the various nail points available, and there's a handy table to help you estimate nail purchases.

If you're a beginner, particularly, you'll want to mount the chart so it's reversible. Illustrated on the back side are practical tips on the handling and use of a hammer, including the art of making a concealed nail joint.

Assistance of the following nail manufacturers in the preparation of this chart is sincerely acknowledged: American Steel & Wire Div., U. S. Steel Corp., Cleveland, Ohio; Independent Nail & Packing Co., Bridgewater, Mass.; W. H. Maze Co., Peru, Ill.; Mid-States Steel & Wire Co., Crawfordsville, Ind.; Nichols Wire & Aluminum Co., Davenport, Iowa; Republic Steel Corp., Canton, Ohio; Reynolds Metals Co., Louisville, Ky.; Sheffield Div., Armco Steel Corp., Kansas City, Mo.; Stanley-Judd Div., Stanley Works, Wallingford, Conn., and Wickwire Brothers, Inc., Cortland, N. Y.

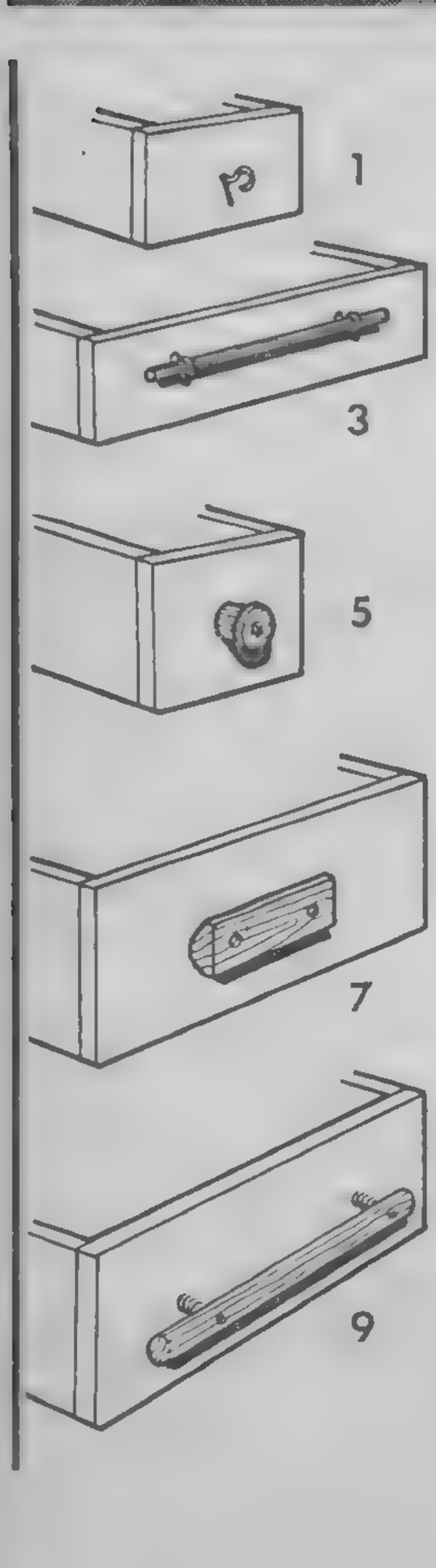
THREADED NAIL DESIGNS



CUT ALONG DOTTED LINE

Home Workshop Drawer Pulls

Here are a few ideas for the wide variety of drawer pulls needed in a well-organized home workshop



(1) A screw-eye is quickest for small wooden drawers.

(2) Glue a golf tee in an undersized hole for a neat two-finger pull.

(3) Slip a wooden dowel through two screw-eyes for wide flat drawers.

(4) Coathanger wire or aluminum clothes line bent to shape and attached with screws makes an adequate small-parts drawer pull.

(5) The half-spool secured with an 8-32 screw is an old stand-by.

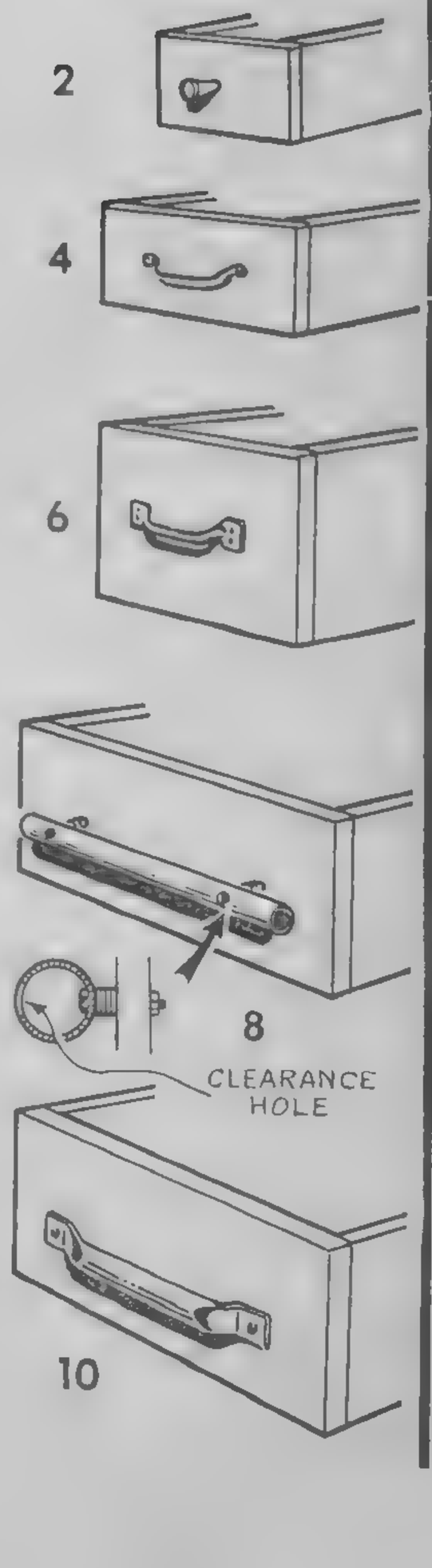
(6) A cast metal sash lift gives the grip required for a drawer filled with heavy tools.

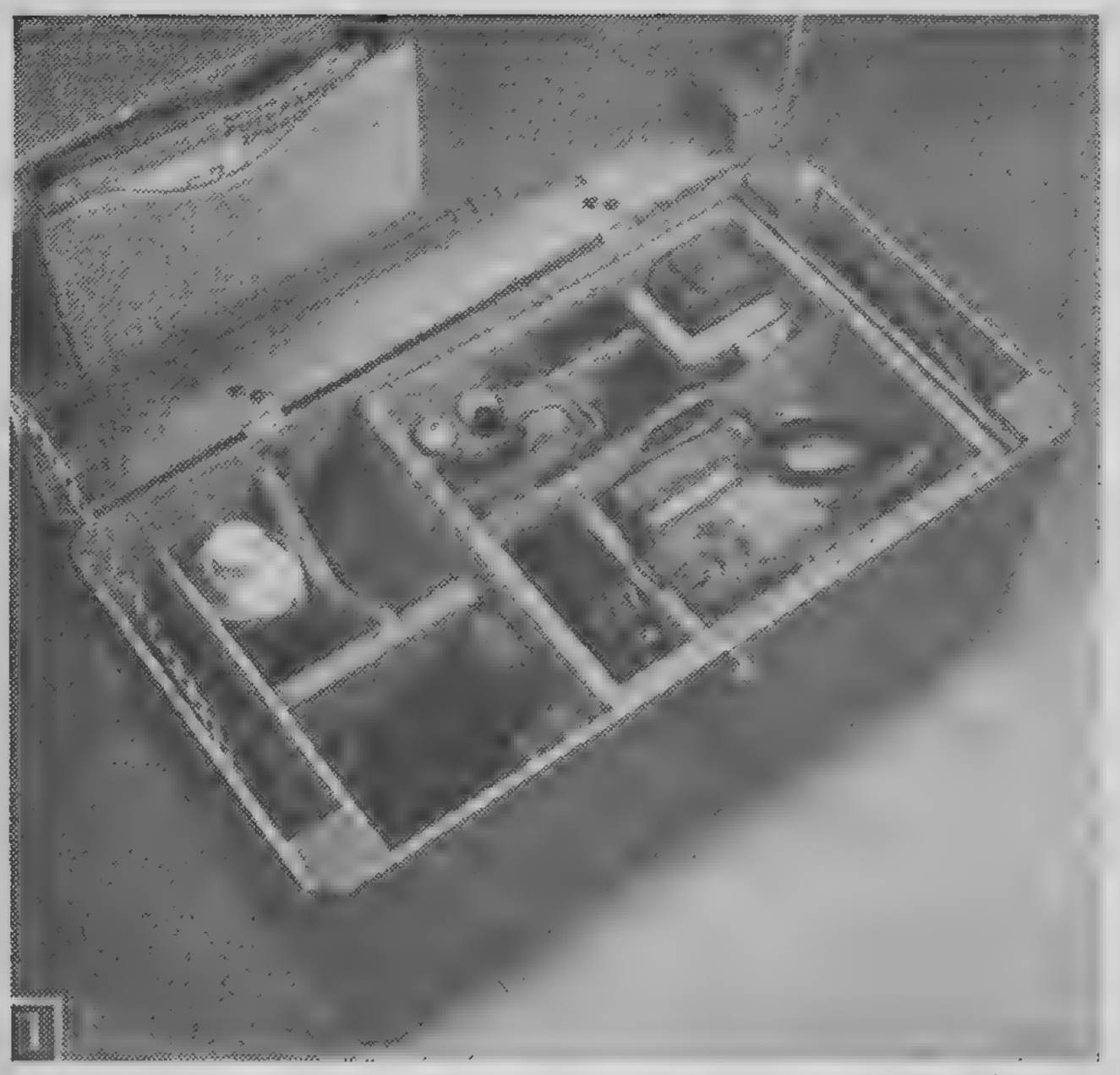
(7) Strips of wood beveled on a table saw and cut to various lengths will work for drawers of any width.

(8) For a tough two-handed pull, drill screwdriver clearance holes through one side of a piece of conduit and bolt holes through the other; attach to drawer front with bolts and washer spacers.

(9) A piece of broom-handle with bolts and washer spacers is the wooden version of the preceding one.

(10) Aluminum tubing, pinched in the vise and bent to shape makes a comfortable, professional-looking drawer pull.





How all the items shown in Fig. 4 fit into this handy case. Lift-out tray is in place here. Note literature rack attached to the top of case.

Portable Home for Your Camera

By R. J. DeCRISTOFORO

KEEPING a pet camera and its many accessories ready-packed for "anywhere" shooting isn't easy. A gadget bag soon becomes too crowded.

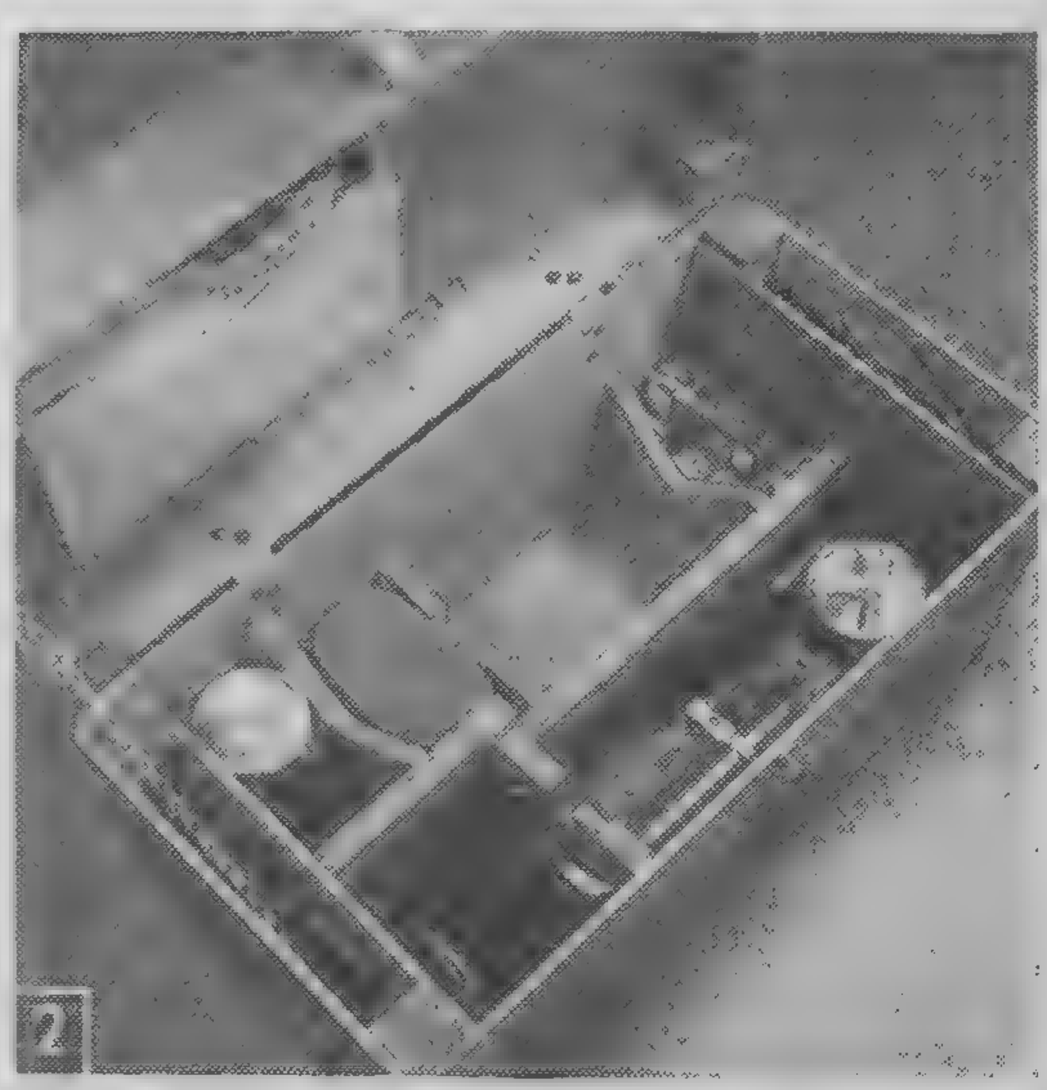
The answer is a special case (Fig. 1) designed exactly for your camera and its accessories. While you can rarely buy a case that will do the job, you can easily make one for less than $5.

Anyone who owns a twin-lens reflex will find this basic design (Fig. 2) ideal, although some interior modifications may be needed to suit individual accessories. Best bet, after the basic case is made, is to lay out all your equipment and check it against the ideas and dimensions shown. If you should decide to reduce the over-all size of the box, remember to include room for things you will add later.

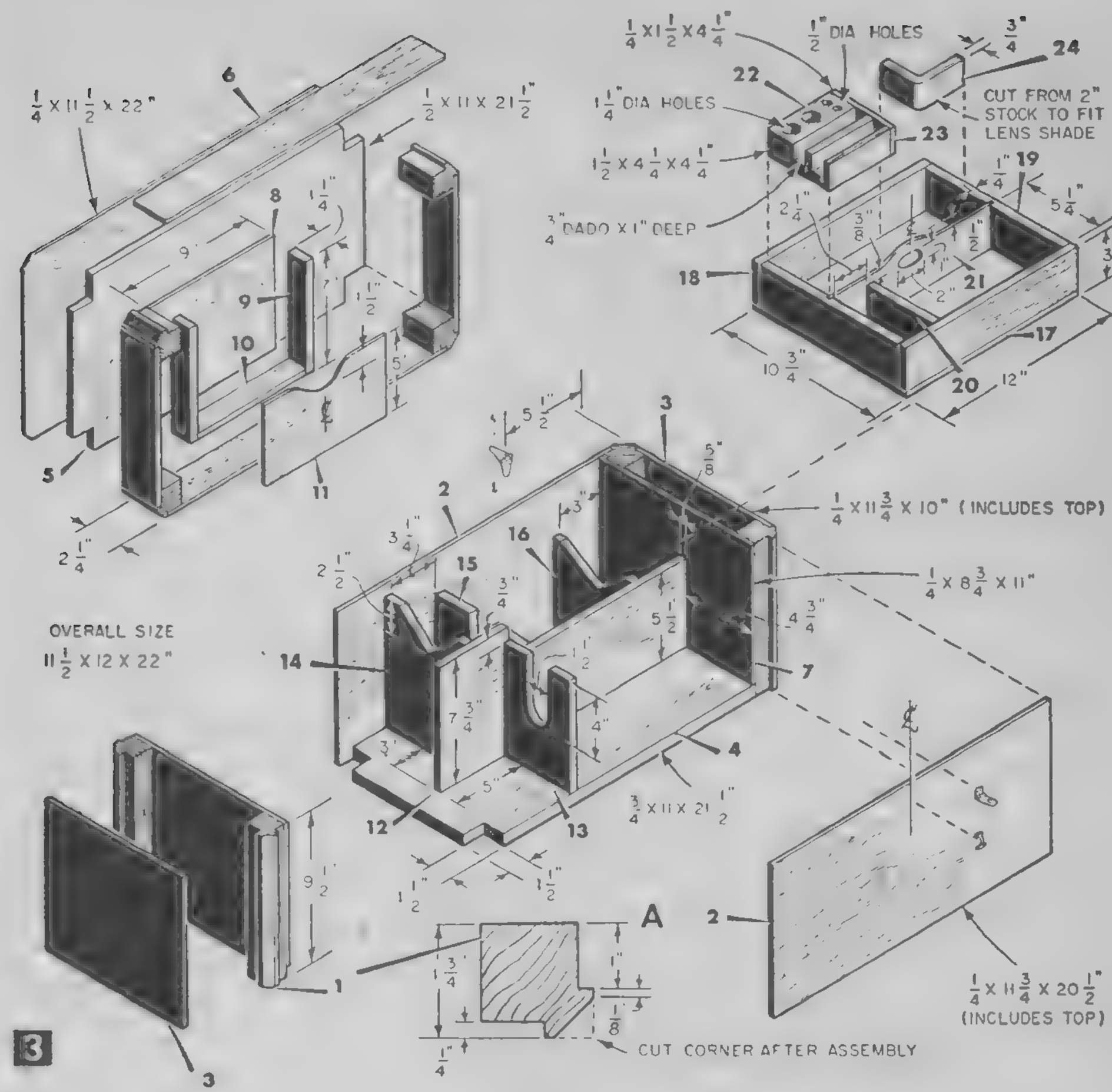
Making the Corner Posts. Cut the corner post rabbets (#1 in Fig. 3) out on a long strip of stock and then cut it to length. Don't chamfer the corners yet. Next cut out sides and ends (parts #2 and #3 in Fig. 3) and assemble them to the corners using plenty of glue and about five 1-in. brads along each joint. Space brads so they won't be on the cut line when you saw off the top of the box.

Next cut the notched top and bottom (parts #4 and 5 in Fig. 3) to over-all size. Then set the box on them and mark off the posts in each corner so the notches you have to cut will be exactly right. Put these in place with glue and 1-in. brads. To complete the basic box, make the cover (part #6) and attach with glue and ⅝-in. brads.

Set your table saw blade at 45° and cut off the corners of the box (Fig. 5). Return the blade to upright position and separate the cover from the body of the box



Lift-out tray has been removed to show lower compartments. Spring-type hooks hold strobe light in place.



(Fig. 6); this technique gives you a perfect fit. Using a hollow-ground blade will minimize edge splintering.

Adding parts #7 inside each end gives you two ready-made compartments for electrical extension cords. The literature rack (attached to lid in Fig. 1) will handle most pamphlets that come with a camera, and is also good for storing filter information and guide numbers. Make the back of the rack (#8 in Fig. 3) first, then fit the other parts to it. Before attaching it to the case cover, assemble it with glue and 5/8-in. brads, and round off all corners on a disc or belt sander. Use 1-in. brads to attach it to underside of cover.

The Body Compartments hold two cans of dulling spray, the camera, a self-contained strobe, auxiliary lens and film. (Fig. 2). And there is still space for future additions. If your equipment differs, change the partitions to suit but be sure to leave the room provided for the lift-out tray. Partitions should provide for a fairly snug fit of equipment to guard against knocks. The relief slots shown in Figs. 2 & 3 enable you to remove equipment easily even if the compartments are snug. To keep

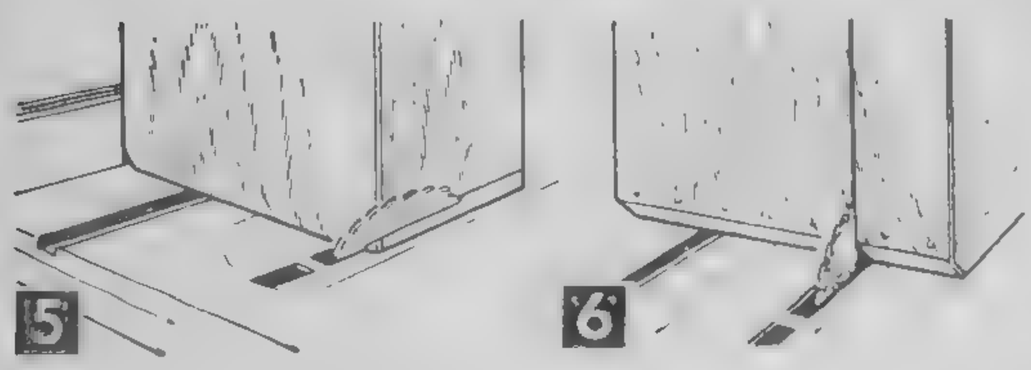
MATERIALS LIST—TRAVELING CAMERA HOME

Part No.	No. of pcs.	Size
1	4	1¾ x 1¾ x 11¾"
2	2	¼ x 11¾ x 20½"
3	2	¼ x 10 x 11¾"
4	1	¾ x 11 x 21½"
5	1	¼ x 11 x 21½"
6	1	¼ x 11½ x 22"
7	2	¼ x 8¾ x 11"
8	1	¼ x 7 x 9"
9	2	½ x 1¼ x 7"
10	1	½ x 1¼ x 8"
11	1	¼ x 5 x 9"
12	1	⅝ x 7¾ x 18"
13	1	⅝ x 4¾ x 7"
14	1	½ x 5⅝ x 7¾"
15	1	½ x 5½ x 5⅝"
16	1	½ x 5½ x 5⅝"
17	1	¼ x 10¾ x 12"
18	2	½ x 2¾ x 12"
19	2	½ x 2¾ x 9¾"
20	1	½ x 2⅜ x 5¼"
21	1	¼ x 3¼ x 11½"
22	1	1½ x 4¼ x 4¼"
23	1	¼ x 1½ x 4¼"
24	1	1½ x 3 x 3¾"

Parts #1, 22 and 24 are pine. All other parts are fir plywood

Hardware: one pair 2" plain strap hinges; one small hasp assembly; one large, screen door handle; 12" of sash chain; 24 #3 x ½" machine screws with nuts for attaching hinges, hasp and chain; four #11 x ¾" flat head screws for attaching screen door handle.

Case has room for all these items—and others you can add later.



the strobe from bouncing around, we used two large kitchen-type spring hooks, obtained from a hardware store.

Assemble the partitions outside the box. Then put them in as a sub-assembly. The lift-out tray (Fig. 1 and parts #17-24 in Fig. 3) is a simple butt-joint affair except for the divider handle, which is dadoed into the end pieces. Cut the sides, ends, bottom and handle, and form the dadoes. Then assemble all the parts using glue and 1-in. brads through the ½-in. stock, and ⅝-in. brads through the ¼-in. bottom. Our tray provides for snug storage of screw-in plugs, lens brushes, self-timer, parallax collector, lens shade, light meter, hand grip and open space for strobe cord and miscellaneous small items.

After sanding all edges carefully, set nail heads under the wood surface and fill. Then apply a resin-type sealer to all surfaces both inside and out. Then add the hardware. Attach hinges with the #3 machine screws (drill #30 holes). After screws are tight, file off ends that project inside case. Use same procedure for hasp assembly. Attach screen door handle to the top. Attach the chain with #3 machine screws (Fig. 1) so the cover will remain upright when opened.

Apply an undercoater to the wood (buy in any paint store) and then use a spray-type hammertone finish.

"I had to change it so we could watch TV."

Modern Multi-Purpose WORKBENCH

By FRANK HEGEMEYER

Craft Print Project
No. 217

NEAT enough to be classed as a piece of furniture, this workbench (Fig. 1) occupies a minimum of floor area, yet has more than 11 cu. ft. of space for storing all the hand tools you'll need, including small portable electric tools and appliances such as a drill, sander, glue pot and soldering iron. It includes such features as a generous-sized linoleum-covered working sur-

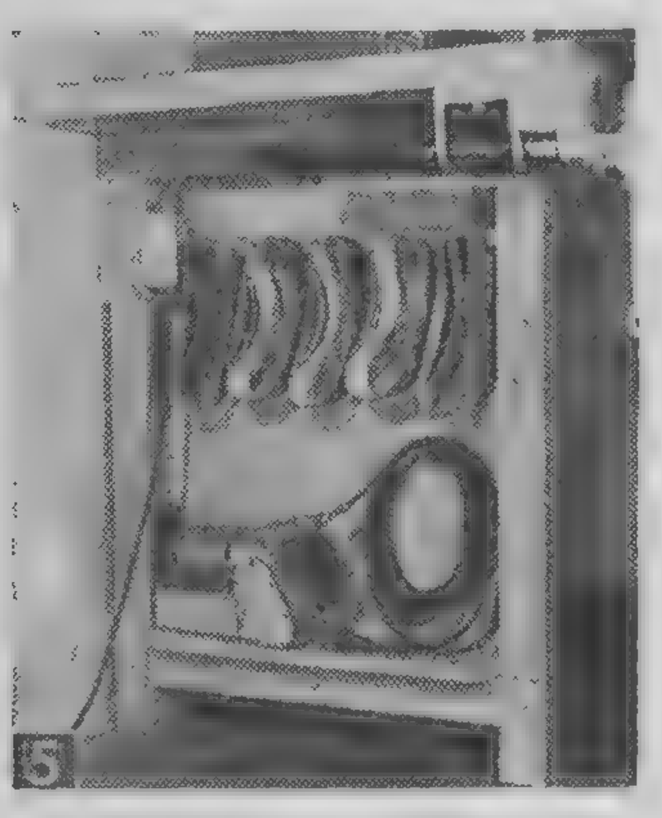
Right, occupying no more floor space than an ordinary desk, this workbench has a place for all your small tools and the equipment you need for hobby crafting to making home repairs or furniture building.

Above. The file and screwdriver cabinet lid can be let down to cover the shaving trough when you need a uniformly flat surface over the entire bench top. It requires no hinges in its raising or lowering action.

Left. The magazine holder provides an ideal location for mounting an electric drill when used to operate a flexible shaft. Note convenience of the lamp to concentrate the illumination on the work.

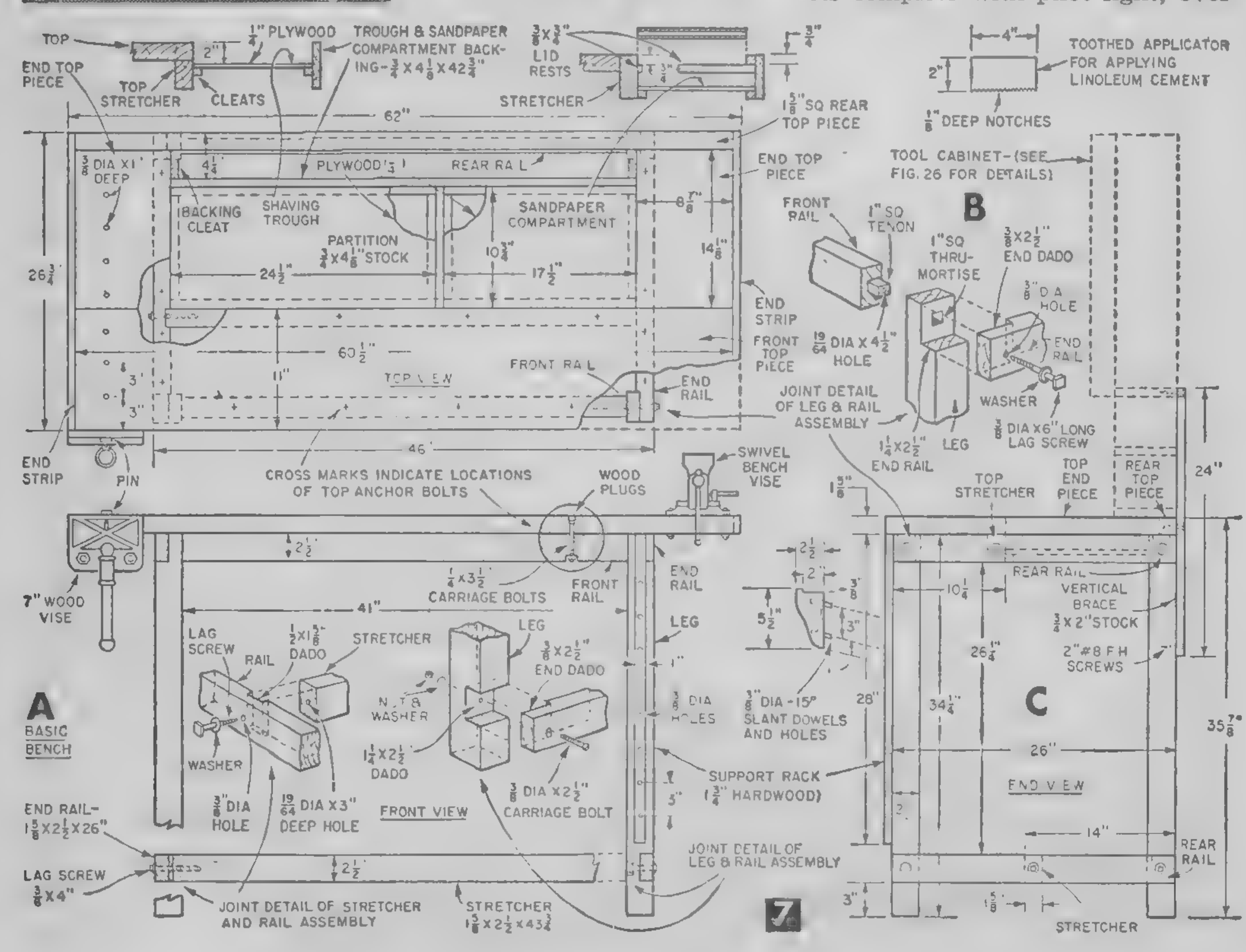
Used in conjunction with the wood vise, this device supports the free end of long work.

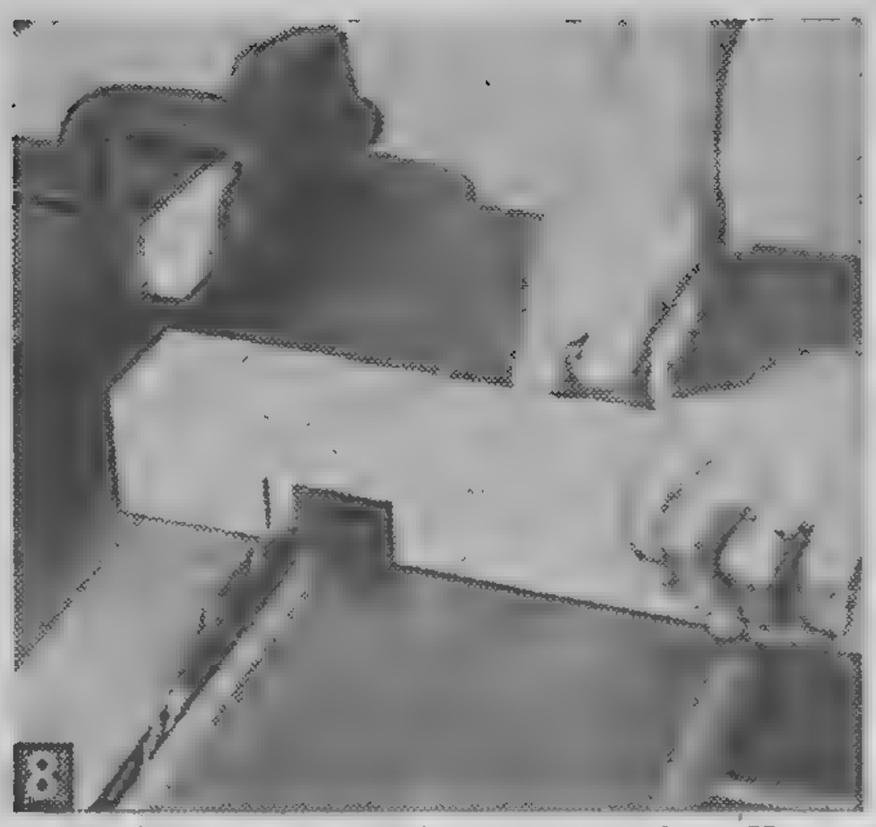
Above, hand tools may be hung on each side of the panel hinged to the inside of the tool cabinet, and inside the door. The back of the cabinet can be used to hold the bulkier tools such as planes.



Left, the side piece of the kneehole cabinet serves as a compartment backing for an electric sander and an assortment of sanding belts. The corresponding area on the opposite side of the bench can be used for small tools, or shelves can be installed to hold small jars of nails, screws, etc.

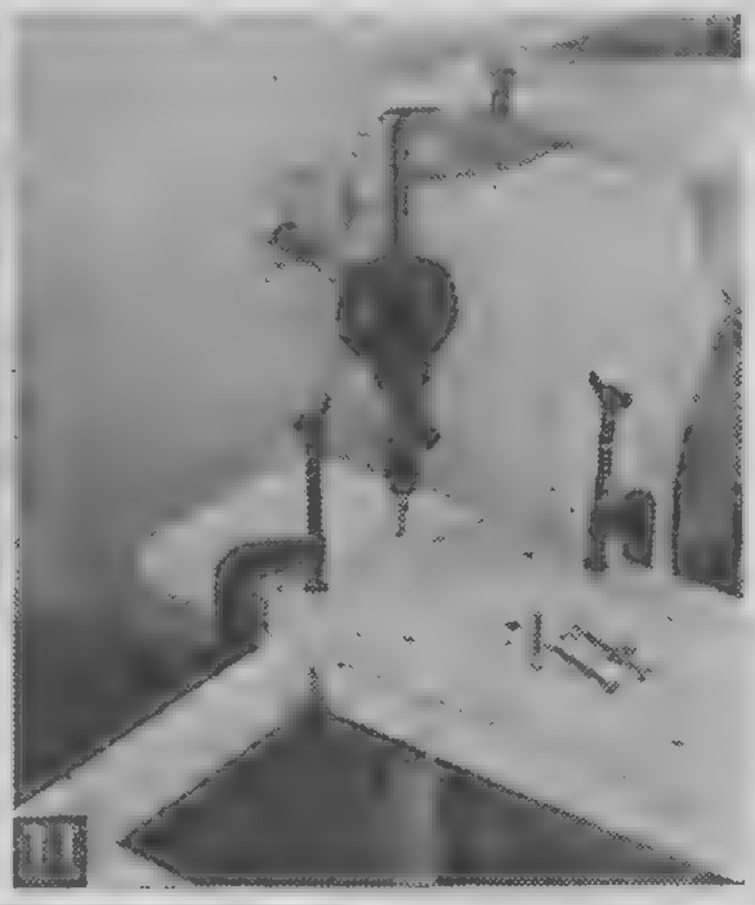
face with a shaving trough which can be covered to provide a flat-topped surface; a compartment for sandpaper and sanding blocks; 5 roomy drawers; 2 tool cabinets; file and screwdriver racks; shelves; magazine holder; built-in electrical outlets complete with pilot light; over-

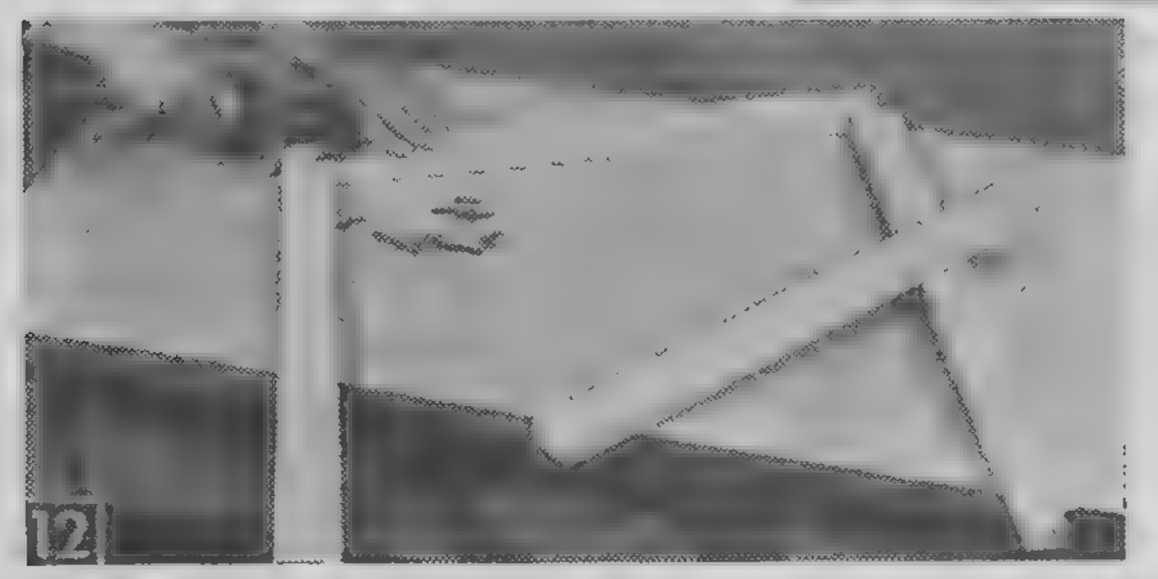




Left, forming the notches in bench leg. Note stop clamped to fence for identically locating duplicate notches on the other three legs. Right, to mortise legs for rail tenons, first bore a 1-in. dia. hole, then square it with a chisel. A wooden block supports the work while chiseling.

Above, the depth of the holes in the tenoned rails is governed by the chisel rest holder which acts as a stop for the work. Right. Coinciding holes to bolt the top piece to the rails and stretcher are assured with the clamping set-up shown above.



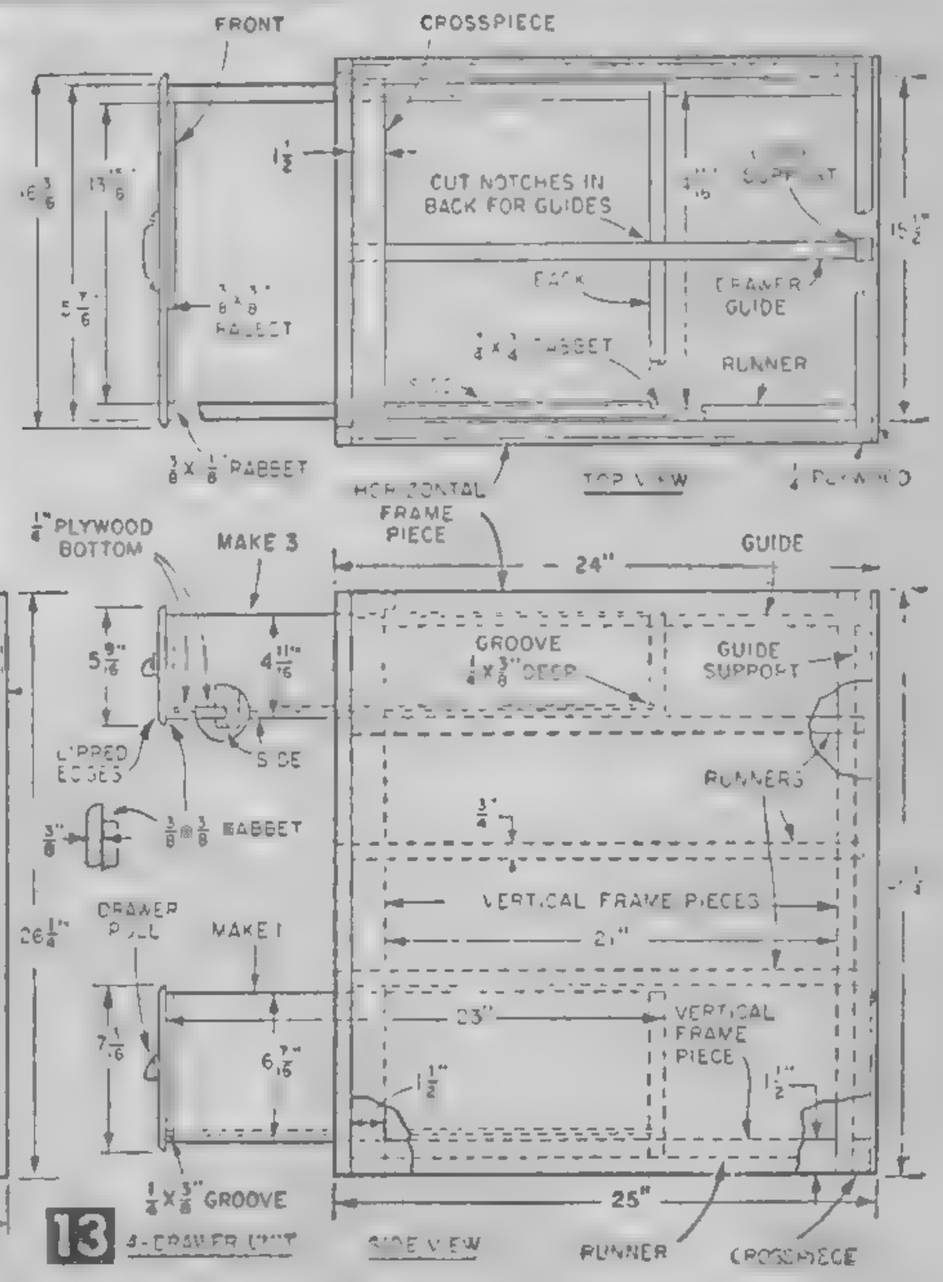


Making the side frames for the 4-drawer unit housing. Note notches cut in one rail for the rear crosspieces.

head adjustable lamp; a supporting device for holding long work and a 20 x 22-in. drawing board. A standard 24-in. high stool, available at most hardware stores, will team up well with the kneehole to enable you to work on small jobs in comfort.

The workbench is made up of seven separate units, so you can build the complete project at one time or just construct the basic bench and add one or more of the other units later on. Use a good grade of pine throughout. Application of linoleum to the bench top is optional, but it provides an ideal work surface, is easy on sharp-edged tools, will give many years of wear and is easily replaced.

The Basic Bench. Cut legs and rails to size (Figs. 7A and 7B), then make joining notches and rail tenons on a circular saw (Fig. 8). Make the through-mortises in the legs for the rail tenons (Fig. 9), then bore the holes in the rails, legs and stretchers for the lag screws and carriage bolts (Fig. 10). Glue is not necessary in the assembly of the legs, rails and stretchers, as tight joints can be had with the lag screws and bolts alone. However, when constructing the six units following, use an adhesive such as *Franklin* glue and cross-nail wherever possible, such as



13

MATERIALS LIST—MODERN MULTI-PURPOSE WORKBENCH

All dimensions in inches

BASIC BENCH

No. Reqd.	Use	Size
4	legs	2½ x 2½ x 34¼
4	end rails	1⅝ x 2½ x 26
1	front rail	1⅝ x 2½ x 43
2	rear rails	1⅝ x 2½ x 43
2	stretchers	1⅝ x 2½ x 43¾
1	top, front	1⅝ x 11 x 60½
2	top, ends	1⅝ x 8⅞ x 14⅛
1	top piece, rear	1⅝ x 1⅝ x 60½
2	top end strips	¾ x 1⅝ x 26¾
1	trough backing	¾ x 4⅛ x 42¾
2	trough backing cleats	¾ x 1½ x 4⅛
1	trough partition	¾ x 4⅛ x 10¾
1	trough bottom (plywood)	¼ x 10¾ x 24½
1	trough bottom (plywood)	¼ x 10¾ x 17½
2	trough bottom cleats	¾ x ¾ x 24½
2	trough bottom cleats	¾ x ¾ x 17½
4	trough bottom cleats	¾ x ¾ x 9¼
1	trough lid (plywood)	¾ x 10¾ x 17½
1	trough lid cleat	⅜ x ¾ x 17½
2	trough lid cleats	⅜ x ¾ x 10⅜
1	support (hardwood)	¾ x 2½ x 5½
1	support rack (hardwood)	¾ x 1 x 28
2	support dowels	⅜ dia. x 2
16	carriage bolts (nuts & washers)	¼ x 3½
2	carriage bolts (nuts & washers)	⅜ x 2½
6	lag screws (with washers)	⅜ x 6
4	lag screws (with washers)	⅜ x 4
16	plugs (hardwood)	¾ dia. x ½
1	floor linoleum (optional)	18 x 72
1 pt.	linoleum adhesive	
1	applicator	⅛ x 2 x 4

4-DRAWER UNIT

(Drawer Frame)

No. Reqd.	Use	Size
4	side framepieces, vertical	¾ x 1½ x 26¼
4	side framepieces, horizontal	¾ x 1½ x 21
2	crosspieces, front	¾ x 1½ x 15½
2	crosspieces, rear	¾ x 1½ x 17
8	runners	¾ x ¾ x 23½
4	guides	¾ x 1 x 23½
1	guide support	¾ x 1 x 23¼
2	sides (plywood)	¼ x 24 x 26¼
1	back (plywood)	¼ x 17½ x 26¼
2	facing, vertical	¾ x 1 x 26¼
1	facing, horizontal	¾ x 1 x 16
3	bearers	¾ x 1 x 16
1	bearer	¾ x 1½ x 16
1 box	corrugated fasteners	
½ lb.	2d (1-in.) finishing nails	
1 lb.	5d (1¾-in.) finishing nails	

(Drawer Parts)

3	fronts	¾ x 5 9/16 x 16 3/16
1	front	¾ x 7 3/16 x 16 3/16
6	sides	¾ x 4 11/16 x 23
2	sides	¾ x 6 7/16 x 23
3	backs	¾ x 4 11/16 x 14 11/16
1	back	¾ x 6 7/16 x 14 11/16
4	bottoms (plywood)	¼ x 14 11/16 x 22⅝
4	pulls	

KNEEHOLE DRAWER UNIT

(Drawer Frame)

No. Reqd.	Use	Size
2	sides	¾ x 4½ x 24¼
1	back	¾ x 4½ x 22¾
2	facings	¾ x 1 x 4½
1	facing	¾ x 1 x 22¾
1	bearer	¾ x 1 x 22¾
2	runners	¾ x 1 x 23½
2	guide	¾ x 1¼ x 23¾

(Drawer Parts)

1	front	¾ x 3 3/16 x 22 3/16
2	sides	¾ x 2 7/16 x 23½
1	back	¾ x 2 7/16 x 20 11/16
1	bottom (plywood)	¼ x 20 11/16 x 23⅛
2	pulls	
1	drawing board (plywood)	⅜ x 20 x 22

KNEEHOLE CABINET

No. Reqd.	Use	Size
2	posts	¾ x 1½ x 21½
2	casings	¾ x 1½ x 21½
2	facings	¾ x ¾ x 20¼
2	framepieces	¾ x 1½ x 10¾
1	framepiece	¾ x 1½ x 21¾
1	framepiece	¾ x 1 x 21¾
2	shelves	¾ x 12¼ x 23¼
2	cleats	¾ x 1 x 10¾
1	top (plywood)	¼ x 13 x 23¼
1	back (plywood)	¼ x 23¼ x 21¾
1	side (plywood)	¼ x 24½ x 21¾
1	door (plywood)	¾ x 10¾ x 20½
1	door (plywood)	¾ x 10⅜ x 20½
1	knob	
1	friction catch	
1	elbow catch	
2 pr.	⅜-in. offset hinges	

FILE & SCREWDRIVER CABINET

No. Reqd.	Use	Size
1	base	¾ x 4¾ x 28½
2	sides	¾ x 4¾ x 12½
1	screwdriver rack	¾ x 2⅞ x 30
1	file rack	¾ x 2⅞ x 30
1	facing (plywood)	¼ x 2⅛ x 30
1	casing	¾ x 1½ x 10¾
1	receptacle panel	¾ x 4 x 10¾
1	back (plywood)	¼ x 12⅞ x 30
1	lid (plywood)	¾ x 10¾ x 24½
1	lid rest, rear	1¼ x 1¼ x 22
1	lid rest, front	⅜ x 1¼ x 24½
1	lid stop	⅜ x 1 x 25½
1	filler	¾ x 1 x 24½
1	bullet catch	

(Electrical Parts)

3	utility outlet boxes
1	combination pilot light & receptacle
2	duplex receptacles
3	duplex receptacle plates
1	armored cable, 40-in. long
6	connectors
1	gooseneck lamp-fixture with mounting bracket & cord
1	10-ft. length rubber covered appliance cord (16 gage)
1	plug cap

MAGAZINE HOLDER

No. Reqd.	Use	Size
2	sides (plywood)	¼ x 5¾ x 12¾
1	back	½ x 6¾ x 12¼
1	top	½ x 5¾ x 7¼
1	bottom	½ x 5¾ x 7¼
1	retainer	⅜ x 2 x 6¾
1	retainer	⅜ x 1 x 6¾

COMBINATION TOOL CABINET & SHELVES

(Cabinet)

No. Reqd.	Use	Size
2	sides	¾ x 5¾ x 34¼
1	top	¾ x 5⅜ x 15¼
3	shelves	¾ x 5⅜ x 15¼
1	back (plywood)	⅜ x 15¼ x 34¼
1	tool panel (plywood)	½ x 14½ x 22
1	tool panel stop	⅜ x 1½ x 3
1	friction catch	
1	brace (see Fig. 2B)	¾ x 2 x 24
3	flathead screws	No. 8 x 2

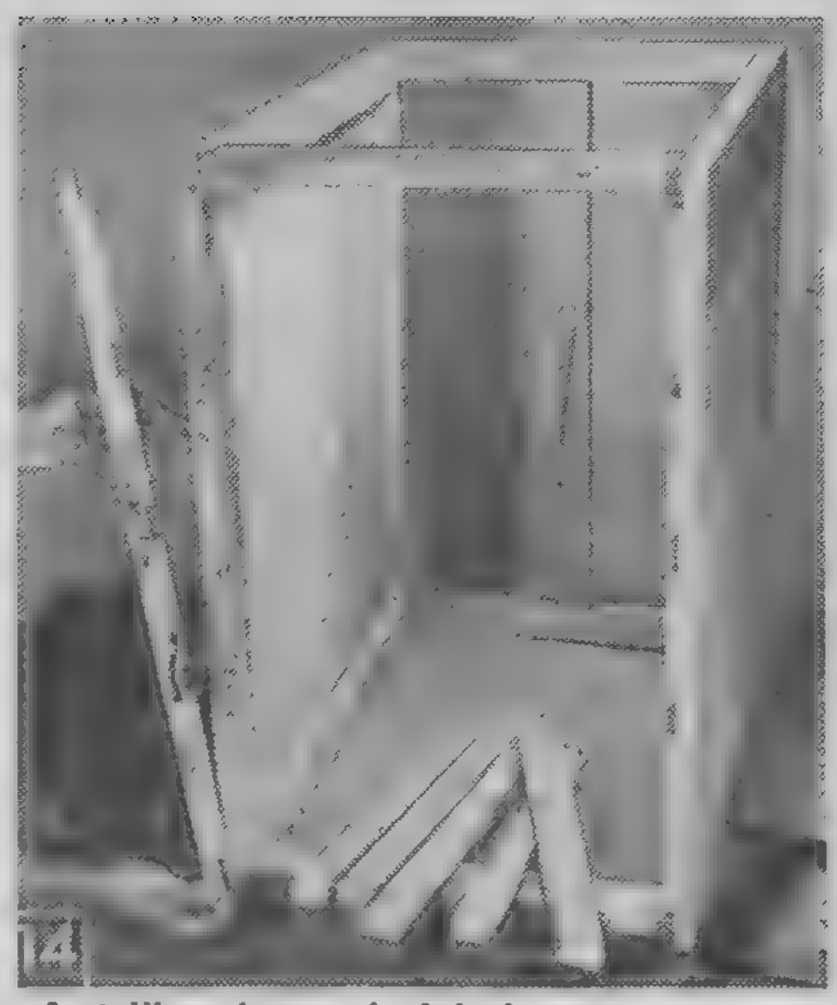
(Doors)

2	sides	¾ x 2½ x 23½
1	top	¾ x 2⅛ x 15¼
1	bottom	¾ x 2⅛ x 15¼
1	front (plywood)	⅜ x 15¼ x 23½
2	knobs	
2 pr.	butt hinges (tight pin)	1½ x 2
1	suitcase bolt	

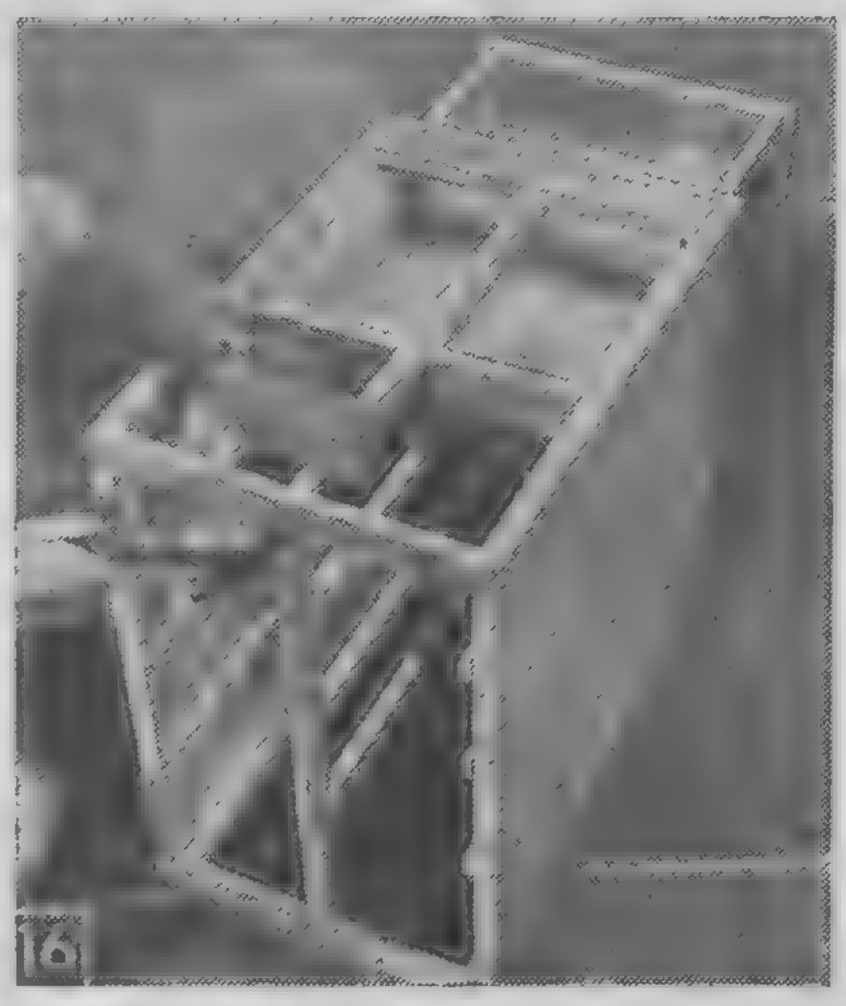
for the end-dadoed joints used in the drawers, combination shelves and tool cabinet.

Bore the holes for the holding bolts in the three top pieces, rails and stretcher simultaneously (Fig. 11). Recess bolt heads and nuts and cover the heads with wood plugs (Fig. 7A). After nailing the rear top piece and end strips, add the trough backing and partition. Next, install the support rack (Figs. 4 and 7). Do not finish top of bench until you have built and installed the 4-drawer unit and the kneehole drawer unit.

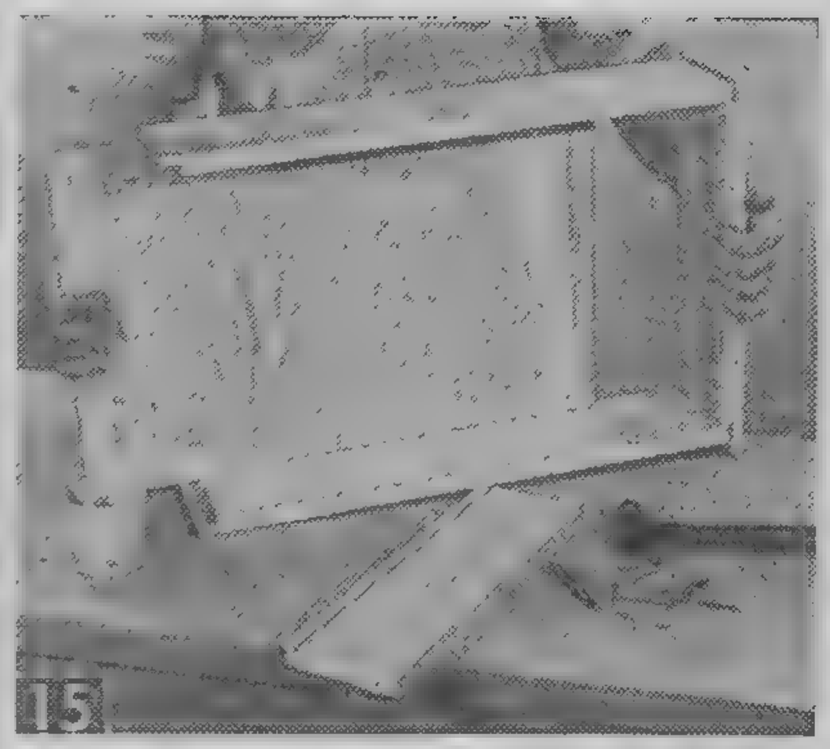
The 4-Drawer Unit. Cut four horizontal and four vertical framepieces (Fig. 13) and join with



Installing the notched facings preparatory to adding the drawers bearers. Glue and nail.



Right, working from the bottom up, fit the runners and guides for each individual drawer.

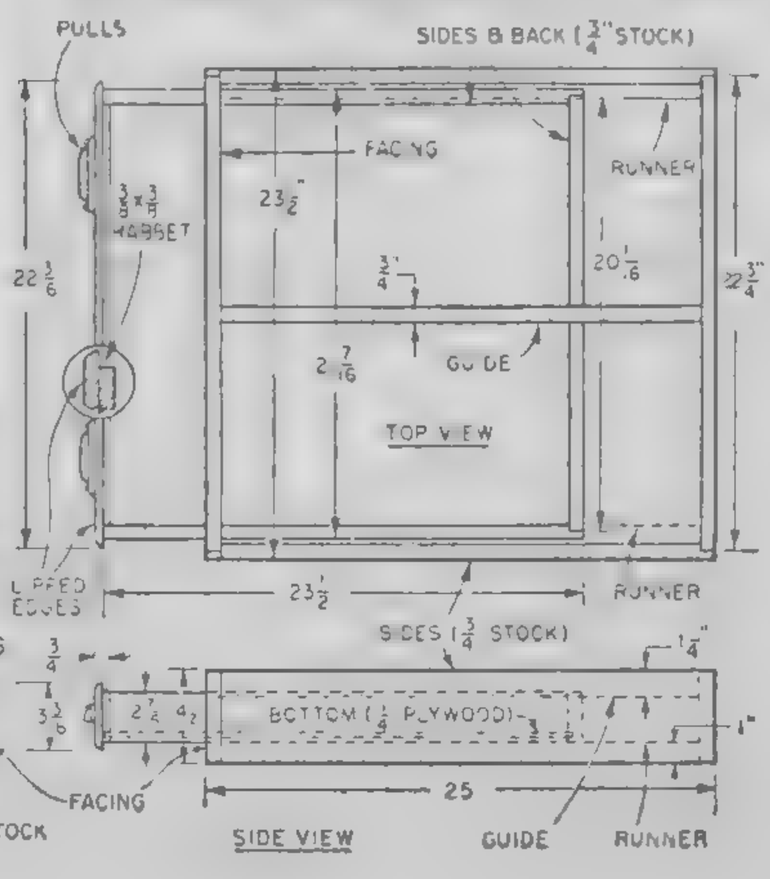


When assembling drawer, nail the sides to the front, then install the bottom and add the back. Glue and cross-nail at the corners.

corrugated fasteners (Fig. 12) to form two frames to which ¼-in. plywood sides are nailed. Join these side frame units with four crosspieces to form the framework for the drawers. Add the guide support, notched facings (Figs. 13 and 14) and drawer bearers.

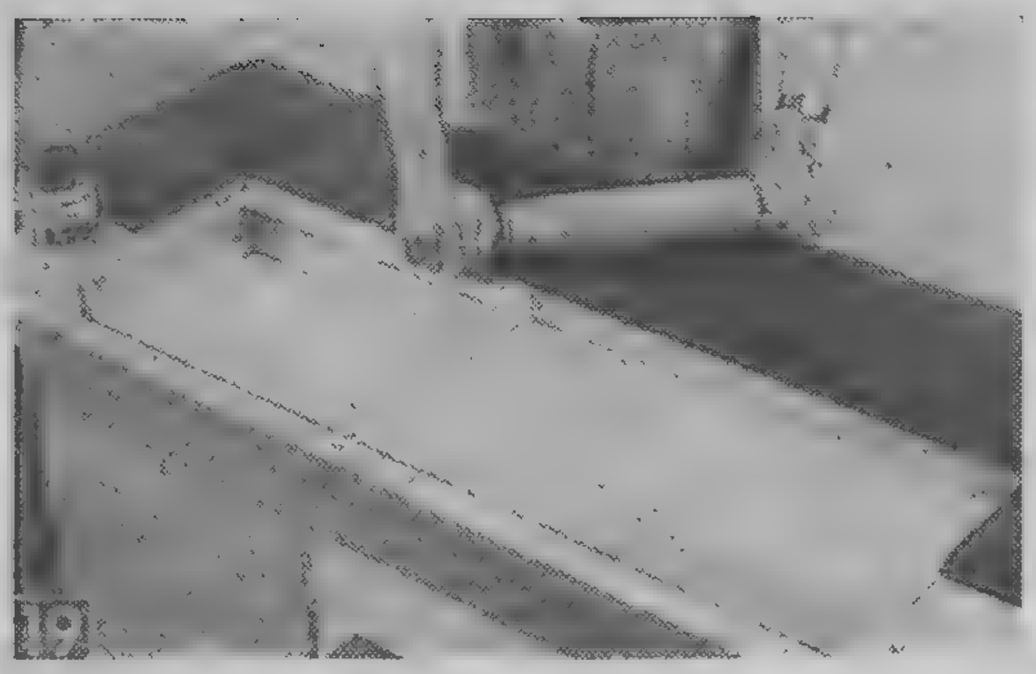
Because the drawers have many duplicate pieces, cut all of the front, back, side and bottom pieces at one time. Note that the bottom drawer is deeper than the other three. Now set up your circular saw and cut ⅜ x ⅜-in. rabbets along the top and bottom edges of the drawer fronts. Then reset the saw and cut ⅜ x 1⅛-in. rabbets on the ends and round off the fronts on all four sides to form a lipped edge (Fig. 13). Then arrange the dado cutters to make a ¼ x ⅜-in. deep groove and saw the sides, front and back pieces for the ¼-in. plywood bottoms (Fig. 13). Assemble the drawer pieces (Fig. 15) with glue and nails. Fit and align the runners and guides in the framework (Fig. 16) for each drawer individually. When completed, position the drawer unit at the right side of the bench with its faceside flush with the front top rail. Nail the framework to the legs, stretchers and rails. Then add the plywood back.

Left, regulate the slant of the drawing board by merely sliding the kneehole drawer in or out. When not in use, the board can be stored on top of the kneehole cabinet located below the drawer.



18 KNEEHOLE-DRAWER UNIT

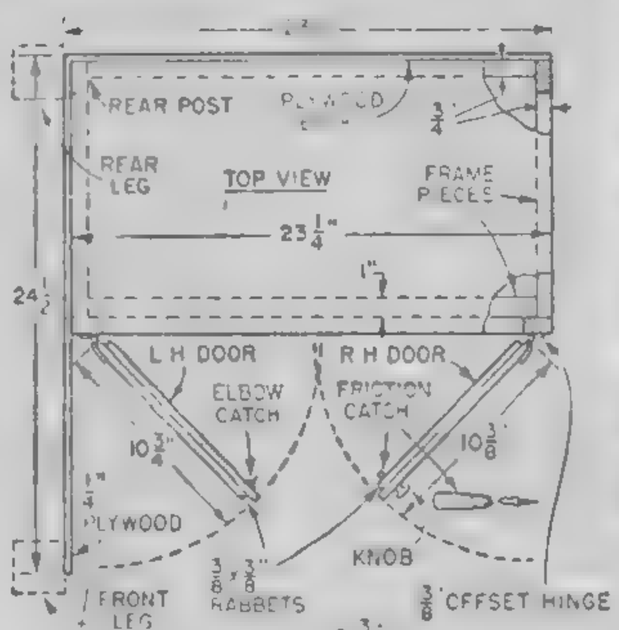
The Kneehole Drawer Unit (Fig. 18). Make this section up separately as you did the 4-drawer unit and install under the top rails



Left, five or six minutes' use of a rolling pin is sufficient to bond the linoleum to the bench top. Use a toothed applicator of 1/8-in. wood (see Fig. 2B) for applying the cement to the wood surface.

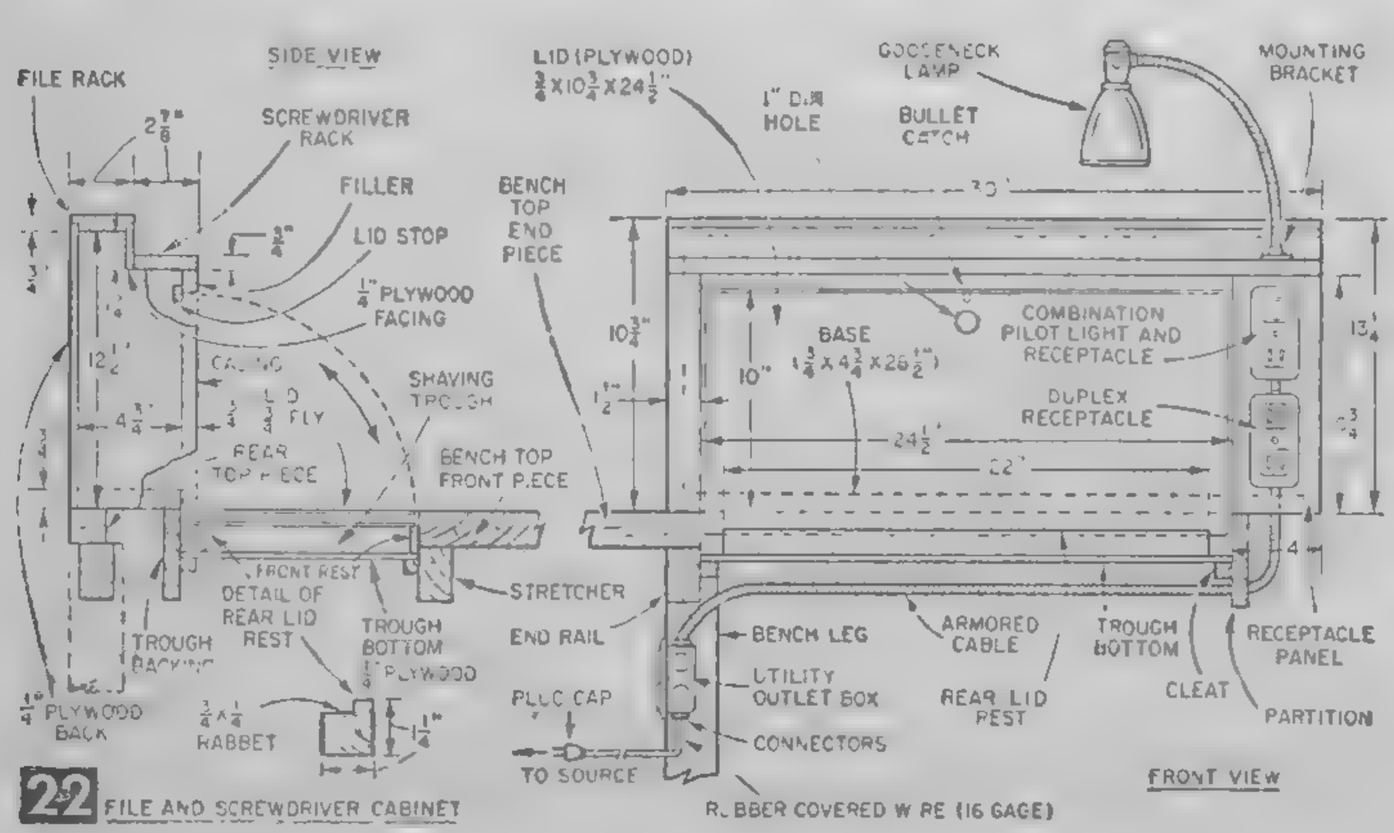
Below, hinging the doors to the kneehole cabinet. Install the cabinet so the lower facing strip is flush with the lower stretcher.

and stretcher. Fasten to the bench by nailing to the 4-drawer unit and the leftside bench legs. If you pull out the drawer about 15 in., it will support a drawing board (Fig. 17).



Finishing Top of Bench. At this point you can install the bottoms of the shaving trough and the sandpaper compartment. If you intend to apply linoleum to the bench top, raise the rests (see Figs. 7 and 22) a distance equal to the thickness of the linoleum, so lids will be flush with bench top surface. When applying the linoleum (Fig. 19), allow it to extend slightly beyond the edges of the bench top. When the adhesive has hardened, dress the linoleum flush with the edges of the bench, using a small block plane. The rear uncovered portions of the bench top ends can be pieced in with scrap linoleum after the three units have been mounted on the bench. If through-bolts are used for attaching the wood vise, mount vise before applying the linoleum.

The Kneehole Cabinet. Notch the shelves of this cabinet (Fig. 21) at the rear for the corner posts and then add the casings, framepieces, cleats, facings, top and back in that order. Lip and rabbet the doors, cutting opposite rabbets on each door where they join in the middle (see top view, Fig. 21). Hang doors with offset hinges (Fig. 20) then add the catches, knob, back and side. The side piece, sandwiched



Plugging in a soldering iron, glue pot or other electrical device automatically turns on a pilot light which reminds you to disconnect the appliance when finished.

To space the holes for the files and screwdrivers, lay out the tools as shown above and mark the hole location on the rack stock. Note file rack already in place.

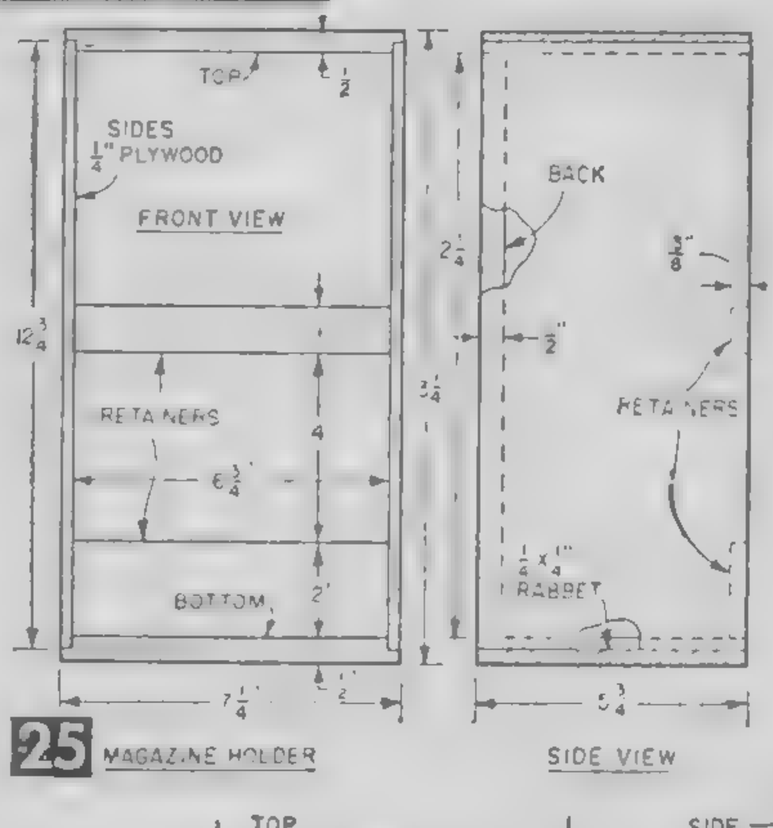
between the left end legs of the bench and cabinet forms a storage compartment (Fig. 5).

File and Screwdriver Cabinet. Cut the openings in the panel for the outlet boxes (Fig. 22) before installing this piece in place. Add the plywood facing and tool racks next (Fig. 24). Do the wiring before nailing the back in place, running the armored cable behind the trough backing to the utility box attached to the left rear leg. Install the pilot light in the upper outlet box (Fig. 23). Install lid rests and lids for both compartments, then add the filler and stop for the shaving trough lid (Fig. 3) to the screwdriver rack.

Magazine Holder. Make and install the magazine holder (Fig. 25) next. This will accommodate approximately 10 copies of SCIENCE AND MECHANICS (Fig. 2) and other 6½ x 9¼-in. magazines.

Combination Tool Cabinet and Shelves. Begin by dadoing the grooves and rabbeted ends and back edge of the two side pieces (Fig. 26). Then nail the shelves, top, bottom and ⅜-in. plywood back to the sides, forming the cabinet frame. This cabinet has what appear to be two doors (see Fig. 6). Fit and hinge the tool panel and install friction catch, stop and knob. Cut out all of the door pieces and before assembling set them up in position on the cabinet frame to see that they line up with the sides, top and shelf. Then glue and nail the door together. When hanging the door, place the hinges on the outside as shown and use small bolts instead of wood screws because of the strain placed on the hinges by tools to be hung on the inside surface of the door panel. Cut notches in the hinged side to prevent interference with the tool-panel hinges as the door is closed. Mount the cabinet to the bench top with wood screws through the bottom shelf and add a vertical brace on the back (Fig. 7C).

Completing the Workbench. After piecing in the uncovered portion of the bench top with scraps of linoleum, protect it while painting by covering it with newspaper held in place with masking tape around the edges. Sand the wood and give it a primer coat followed by another sanding and two or three coats of enamel. When thoroughly dry, remove the protective paper and install the drawer pulls and suitcase bolt. If the metal vise you have is not equipped with pipe jaws, there is sufficient area behind the vise for mounting a small pipe vise.



25 MAGAZINE HOLDER

26 COMBINATION TOOL CABINET & SHELVES

● Craft Print No. 217, in enlarged size for building the Multi-Purpose Workbench is available at $1.50. SPECIAL QUANTITY DISCOUNT! If you order two or more craft prints (this or any other print), you may deduct 25¢ from the regular price of each print. Hence, for two prints, deduct 50¢; three prints, deduct 75¢, etc. Order by print number. To avoid possible loss of coin or currency in the mails, we suggest you remit by check or money order (no C.O.D.'s or stamps) to Craft Print Dept. 2098, SCIENCE and MECHANICS, 450 East Ohio Street, Chicago 11, Illinois. Now available, our new illustrated catalog of "196 Do It Yourself Plans," 10¢. Please allow three to four weeks for delivery.

Attractive design built from odds and ends will harmonize with most home exteriors. It's just wide enough to hold newspapers mailed in full width wrappers.

Modern Mailbox

Smart depository holds nearly everything the postman brings, even newspapers and small parcels

NEVER again will your important papers or a favorite magazine be battered by the elements because the postman couldn't squeeze them into your mailbox, if you switch to the type in Fig. 1.

We built the box as shown in Fig. 2, using various wood pieces from our scrap pile, which accounts for the several different thicknesses used. If you don't have the wood handy, you can cut out all parts from a 7-ft. length of 1 x 8 in. stock (actual size ¾ x 7½ in.). It's an easy one-evening project with hand or power tools.

Cut out all pieces as shown in Fig. 2. Lay out the scalloped edge for the front on 1-in. squares as in Fig. 2A and cut it with a band saw, jig saw or coping saw. You can mold an ornamental edge as in Fig. 2B along the scalloped area, as well as on the lid and top, if you have access to a shaper or router. Recess the back into sides and top. Where no circular saw is available, cut the back piece ⅜ in. lower and ¾ in. narrower, then install it with brads or screws against ½ x ¾-in. cleats as in Fig. 2C.

For a decorative feature, fasten the front to the sides with ⅜-in. dowel pins, then fasten all remaining parts except the lid with glue and 6*d* finishing nails. Drill two holes for mounting screws through the back as in Fig. 2 or as determined after checking your location for the mailbox.

Where the wood selected has attractive graining, prime it with shellac diluted 50-50 with alcohol, then finish with varnish. Should the wood not match too well, hide the grain altogether by finishing with a primer and one or two coats of house paint to blend or contrast with your basic house color. When dry, attach the lid with your choice of hinges, then mount the box in its permanent position. Attach with roundhead screws through washers and the back holes.—MILT GRASSELL and CARL WIESINGER.

MATERIALS LIST
MODERN MAILBOX

No. Req.	Size and Description
1 pc.	¾ x 7½ x 28" (front, sides)
1 pc.	⅝ x 1 x 17¾" (top)
1 pc.	½ x 5¾ x 17¾" (lid)
1 pc.	½ x 2⅜ x 15½" (base)
1 pc.	¼ x 7⅜ x 16¼" plywood (back) (Above pieces scrap wood, preferably hardwood)
1 pc.	⅜" dia. x 7" dowel (dowel pins)
1 pr.	ornamental hinges with ½" screws
Misc.	2 #8 x 1¼" *rh* screws with washers, 1" brads, 6*d* nails, glue, shellac, varnish

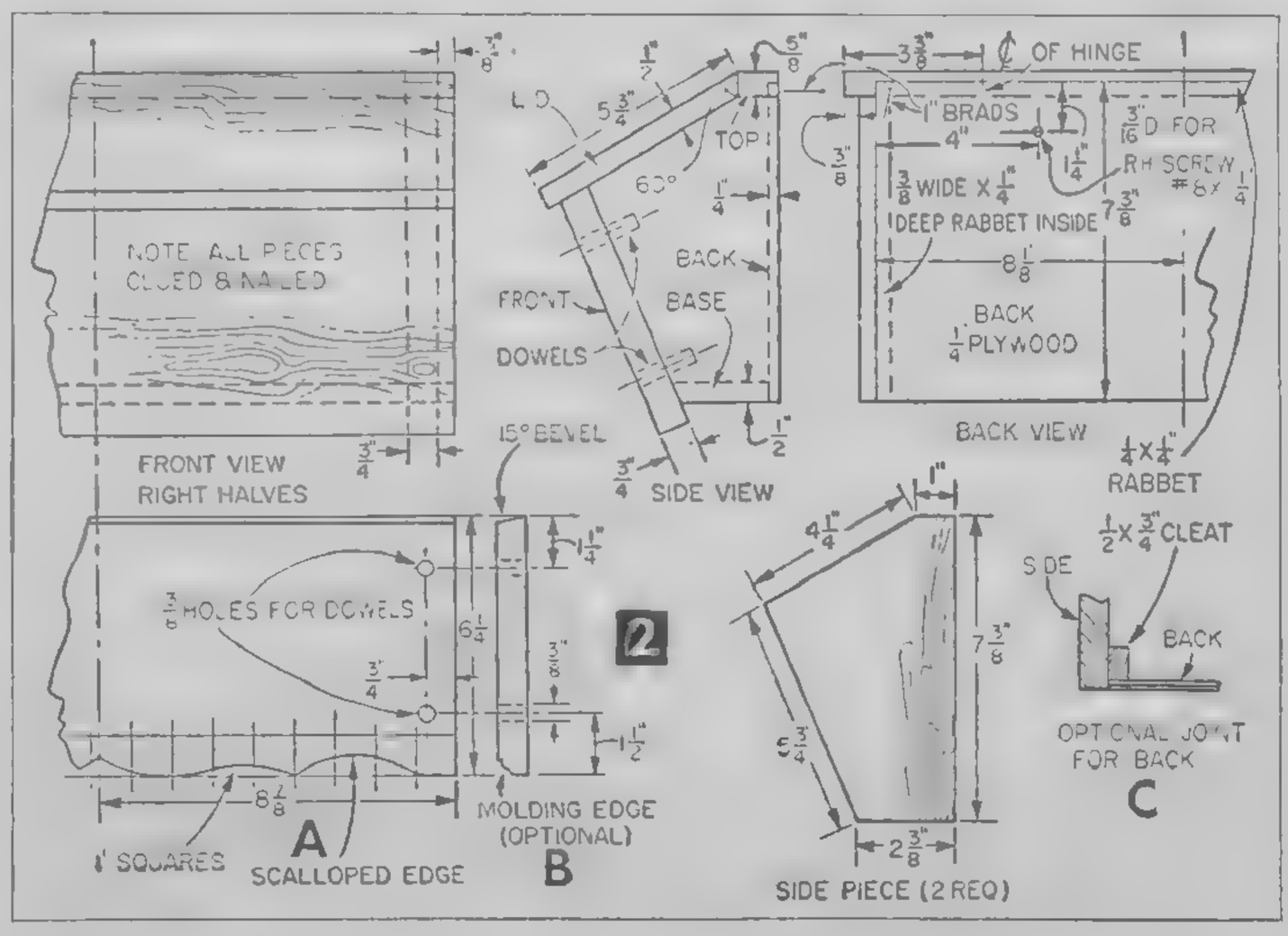


Fig. 1. V-block setup on compound rest with small boring bar. Block is held on side by tool post stud fastened to special nut fitting T-slot. Clamp angles point inward for small diameter work. Fig. 2. Milling tool bit slot on end of a boring bar. V-block is clamped sideways in milling attachment vise. Block clamp angles point out for large diameter work. Fig. 3. For drill press operation, V-block is held to table by socket head capscrew recessed in hole counterbored through center of the V.

Versatile V-Block for Round Work

By FRANK C. FEHELY

A REAL handy-Andy around any shop is a solid steel V-block shown in use as a boring bar holder, milling jig and drill press jig, respectively, in Figs. 1 to 3.

This multi-purpose round work holder can be built with your engine lathe from 1 x 2-in. cold rolled steel (*crs*). You can align it with —or fasten it to—a T-slot on any machine, using locating buttons and T-nut attachments. There's complete clearance for drilling and boring with the usual table clamps replaced by a socket-head cap screw recessed in a counterbored hole. And the hole is centered so that the block can be trued up with a test indicator central with the spindle of any machine.

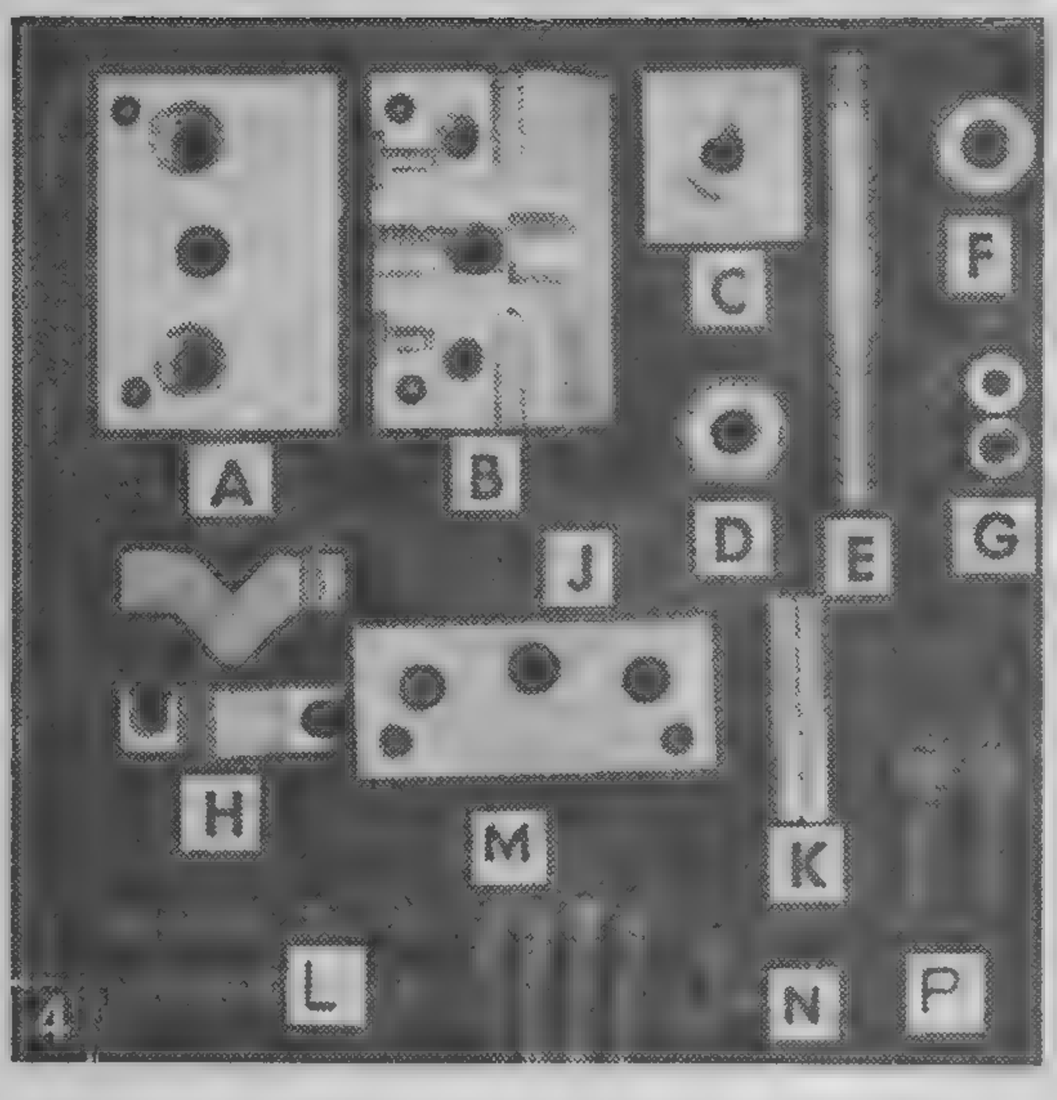
The block will handle work up to 3-in. dia., using a 1-in. spacer block. It can hold boring bars up to 1⅛-in. dia. with extra rigidity because there are two clamps instead of the usual one, and each is fastened at two points. You can easily change from small to large diameter work, and back again. Specially slotted V-clamps can be removed, reversed and replaced quickly, without removing capscrews. Tapped holes for clamping are provided at each end, a slide and on the bottom. For accurate replacement of work, a stop may be clamped at either end.

Block Construction. Figure 4 shows all parts of the V-block as shaped to the dimensions in Fig. 5. Begin work by cutting two 1 x 2 x 2⅛-in. pieces of cold rolled steel for the body parts, using a power hacksaw. The inch thickness will fit any 9 or 10-in. engine lathe. Otherwise, to determine exact thickness. measure the height from top of the compound rest to center of the lathe spindle. This will eliminate any need for shims to place the center of the V-block on the center of the lathe spindle.

Finish ends square, to 3-in. long as in parts A and B of Fig. 5. Paint ends with layout blue and scribe 45° lines with a combination square. Remove two opposite jaws of the 4-jaw chuck and set up work with the 45° angle of the square (Fig. 6), using copper, brass or aluminum strips between chuck jaws and the work to prevent marring. Machine finish the angle on each block with a lathe milling attachment.

Lay out and center punch locations for the two ⅜-16 socket-head capscrew on the side of the block's upper body (Fig. 5A). Clamp parts A and B together in your lathe after checking alignment and drill two 5/16-in. holes through them at these locations. For accuracy, it's best to start these and all other holes with a ⅛ or 5/32-in. drill ⅛ to ¼-in. deep. Use cutting oil or other coolant in all drilling operations.

Separate block halves and enlarge holes in part A to ⅜-in. dia. Enlarge them again as in Fig. 5A with a 19/32-in. counterbore or drill—*only* to a depth of 13/32 in. If you don't have the counterbore, set up the work in the 4-jaw chuck and counterbore with a boring tool. Slightly countersink holes in part B to help start the tap, then run a ⅜-16 tap through them. If you do not have a tap guide plate or block, use the tailstock center of your lathe to center the tap square with the face of the work. Engage lathe back gear at lowest speed, acting as a brake to hold the work, which is not revolved. Feed tap into the work three or four turns with a wrench. If you



Parts of the V-block. A through J are dimensioned in Fig. 5, K shows steel dowel pins and L through P various socket head capscrews used.

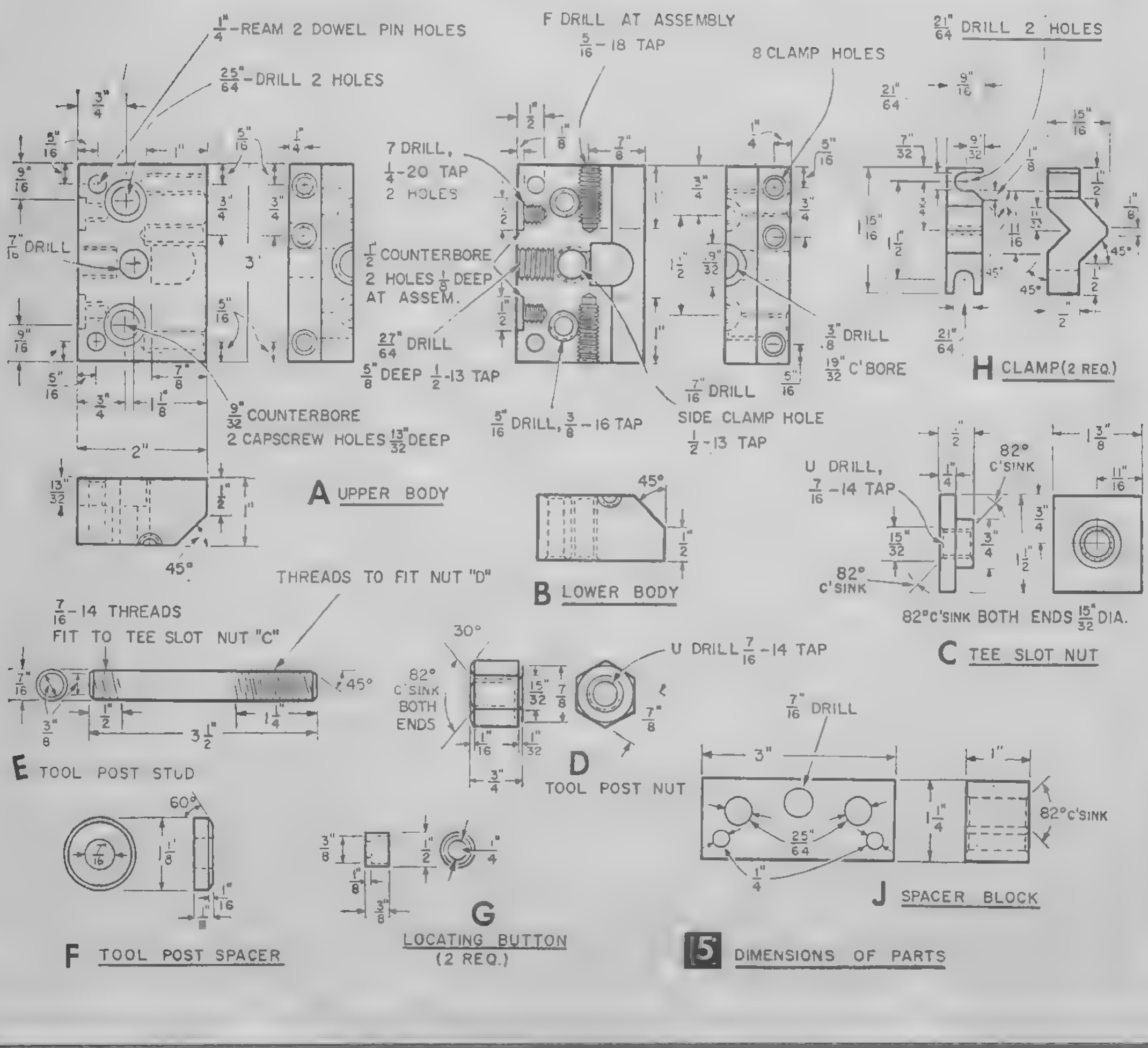
prefer, you can hold the tap in a drill-press chuck and cut the first few threads by revolving the belt by hand. Remove work from lathe or drill press, place in bench vise and finish the operation with a tap wrench. A mixture of white lead and cutting oil facilitates the job.

Now enlarge the 3/8-in. holes in part A to 25/64 in., to help align the two block halves. Clamp parts A and B together with the 3/8-16 x 2½-in. socket head capscrews, aligning carefully. Layout and center punch the locations for ¼-in. dia. dowel pins as in Fig. 5A and drill 15/64-in. holes through both

MATERIALS LIST—MULTI-PURPOSE V-BLOCK

No. Req.	Size and Description
1	1 x 2 x 13" cold rolled steel (body, spacer, T-slot nut, tool post spacer, clamps)
1	7/8 x 7/8" cold rolled steel hexagon (tool post nut)
1	7/16" dia. x 3 5/8" cold rolled steel rod (tool post stud)
2	½" dia. x ½" cold rolled steel (locating buttons)
2	¼" dia. x 1 15/16" steel dowel pins
2	3/8–16 x 2½" steel socket head capscrews
2	3/8–16 x 1¼" steel socket head capscrews
4	5/16–18 x 1¼" steel socket head capscrews
2	¼–20 x ½" steel socket head capscrews

Note: Modify 1" dimension for body parts to suit your lathe. Select tool post nut hexagon size to fit your tailstock socket wrench



5 DIMENSIONS OF PARTS

parts. Separate the parts and ream the holes to ¼-in. for a slip fit in Part A and a tight fit in B. Insert pins.

For side clamping to hold block to a T-slot, clamp A and B together again. Lay out and locate center as in Fig. 5A, then drill a 7/16-in. hole. Separate parts and run a ½-13 tap through hole in B.

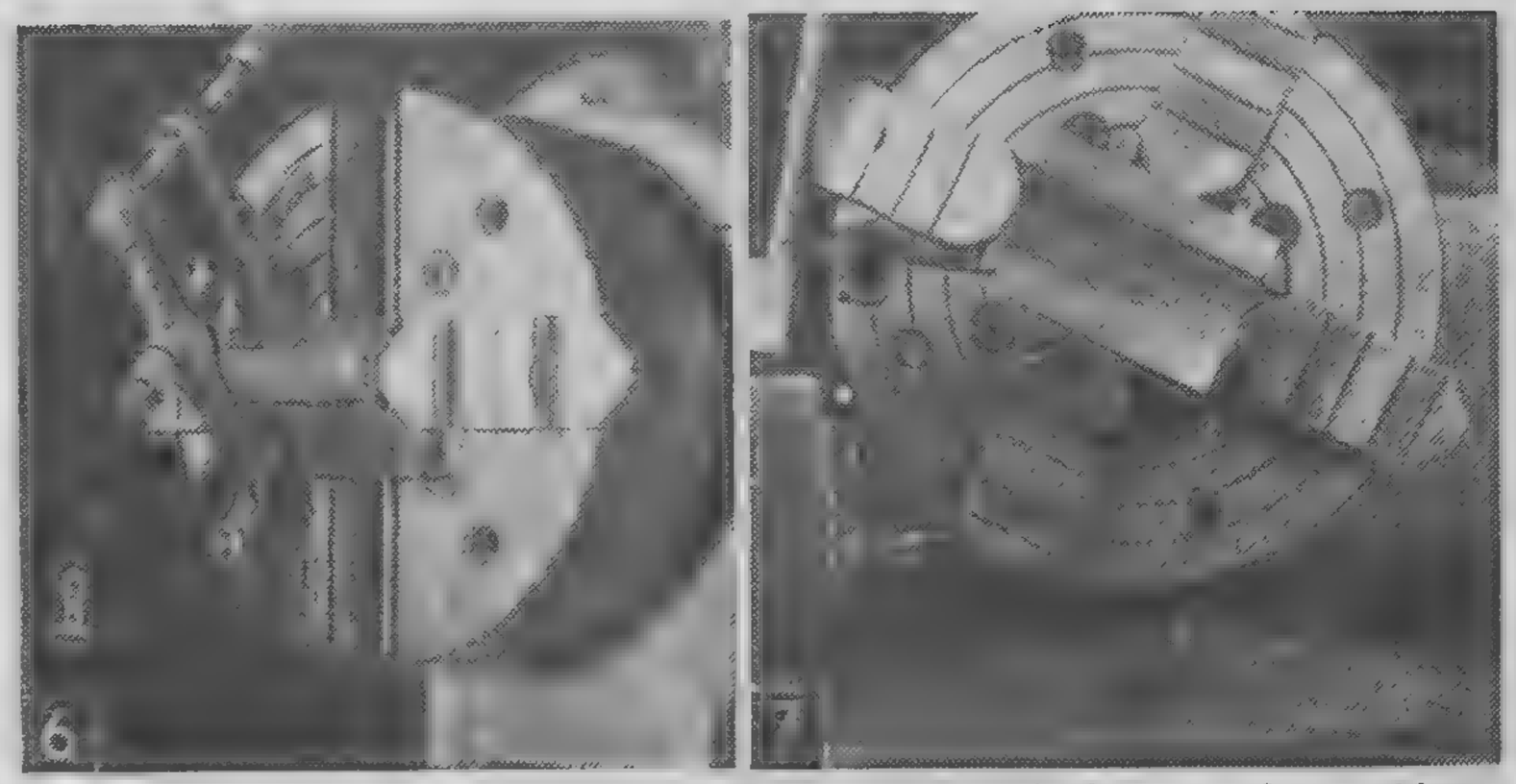


Fig. 6. Two opposite jaws of a 4-jaw chuck hold block body parts after position is determined by combination square for machine finishing at 45° angle. Fig. 7. Test indicator checking for trueness on face of V-block when held in the lathe chuck, preparatory to drilling and counterboring through the V.

Setup for the V Counterbore, which will let you clamp the block to any machine table. Put the parts together again and clamp block V face out in your 4-jaw lathe chuck, using tailstock center to hold in position. Slip thin metal strips between chuck and block to protect from marring. True up face of the V block with a test indicator, then check sides and ends of V-block central with the lathe spindle. Double check face with the indicator. Drill a ⅜-in. hole in center of the V, then counterbore hole to 19/32-in. dia. with depth to ⅞ in.

With block still clamped in this position, use tailstock center to locate the six clamp holes on the face. Drill, countersink and tap the holes as in Fig. 5B. Reclamp block on an end and repeat the process for the end clamp hole centered below the V. Do the same on the other end.

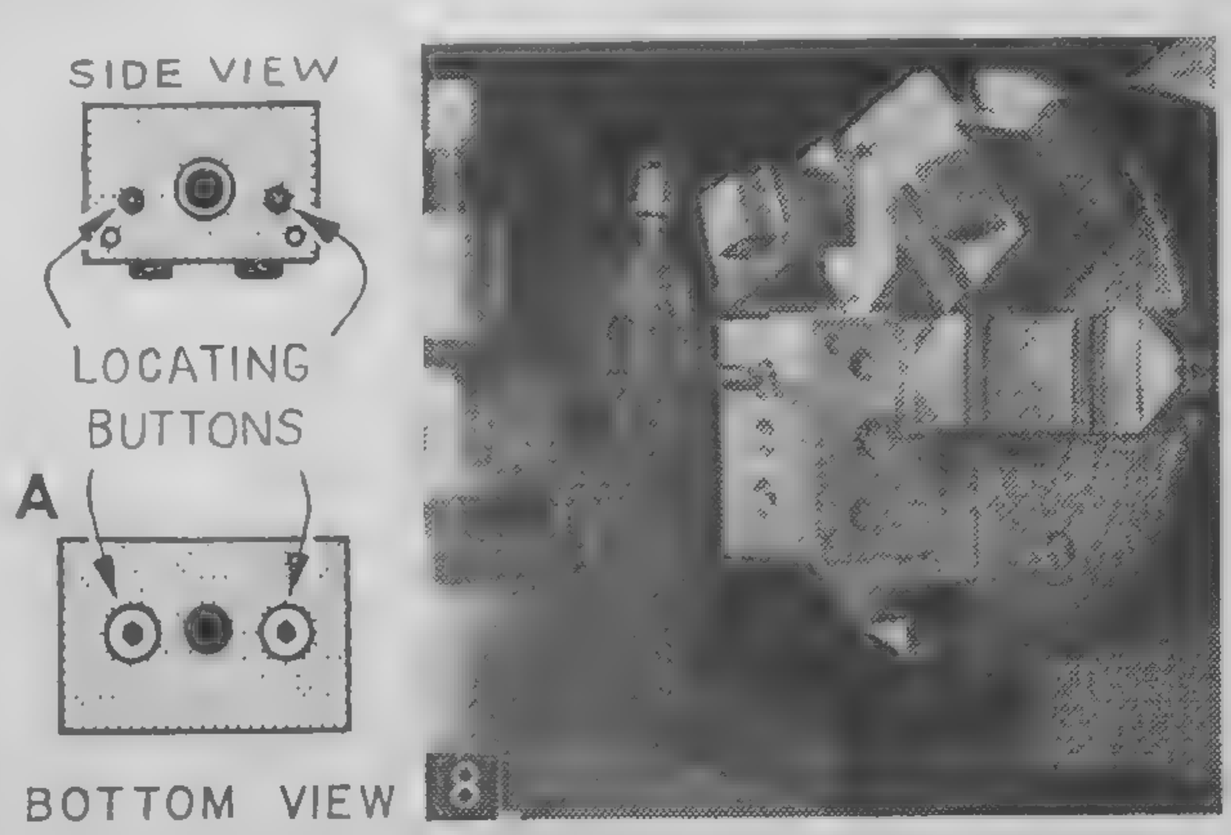
Now clamp block bottom side out for installation of locating buttons (Fig. 8A) which will align the block parallel to a T-slot. Locate a counterbore with the tailstock center, then true up bottom and sides of block as before. Drill, tap and counterbore as in Fig. 5B, using your boring bar for the shallow counterboring as shown in Fig. 8. Turn block around, center other counterbore location and repeat. Install ¼-20 x ½-in. socket-head capscrews. Shape two locating buttons to fit counterbores as in Fig. 5G.

T-Slot Nut. Dimensions for the T-slot nut given in Fig. 5C are for a 9-in. South Bend engine lathe. Modify them to fit the compound rest T-slot of your lathe. Use a 4-jaw chuck to face, turn, drill and tap the 7/16-in., 14-thread hole. Shape the tool post stud and nut as in Fig. 5D and E. Hold the tool post stud in a 3-jaw chuck and screw the T-slot nut onto the stud. Face the bottom of the nut square to the tapped hole and to required thickness. Shape the tool post spacer as in Fig. 5F.

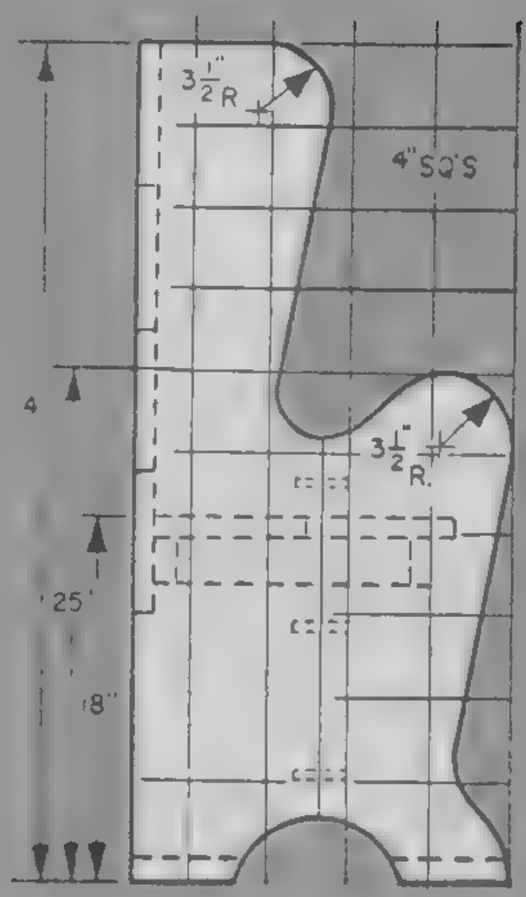
Reversible Clamps. Cut two ⅝ x 1 x 2-in. pieces out of *crs* stock for the work clamps, finishing to dimensions in Fig. 5H. Paint with layout blue and scribe the 45° angle lines. Hold one clamp in the vise of your lathe milling attachment, using a combination square to set the angle, or swivel the compound rest to 45°. Machine the angles with an end mill or flycutter. Lay out, center punch and drill 21/64-in. dia. holes as in Fig. 5H. Make the slot cutouts with a hand hacksaw and finish, or mill them in the lathe milling attachment.

Spacer Block. Cut a 1 x 1¼ x 3⅛-in. piece out of *crs* stock and finish ends square to 3-in. length. Clamp upper half of block (Fig. 5A) to spacer (Fig. 5J), aligning carefully on the side of block containing the ½-in. locating counterbores. Spot drill the ¼, 25/64 and 7/16-in. holes through the block into the spacer, then remove clamps and finish drilling through the spacer separately.

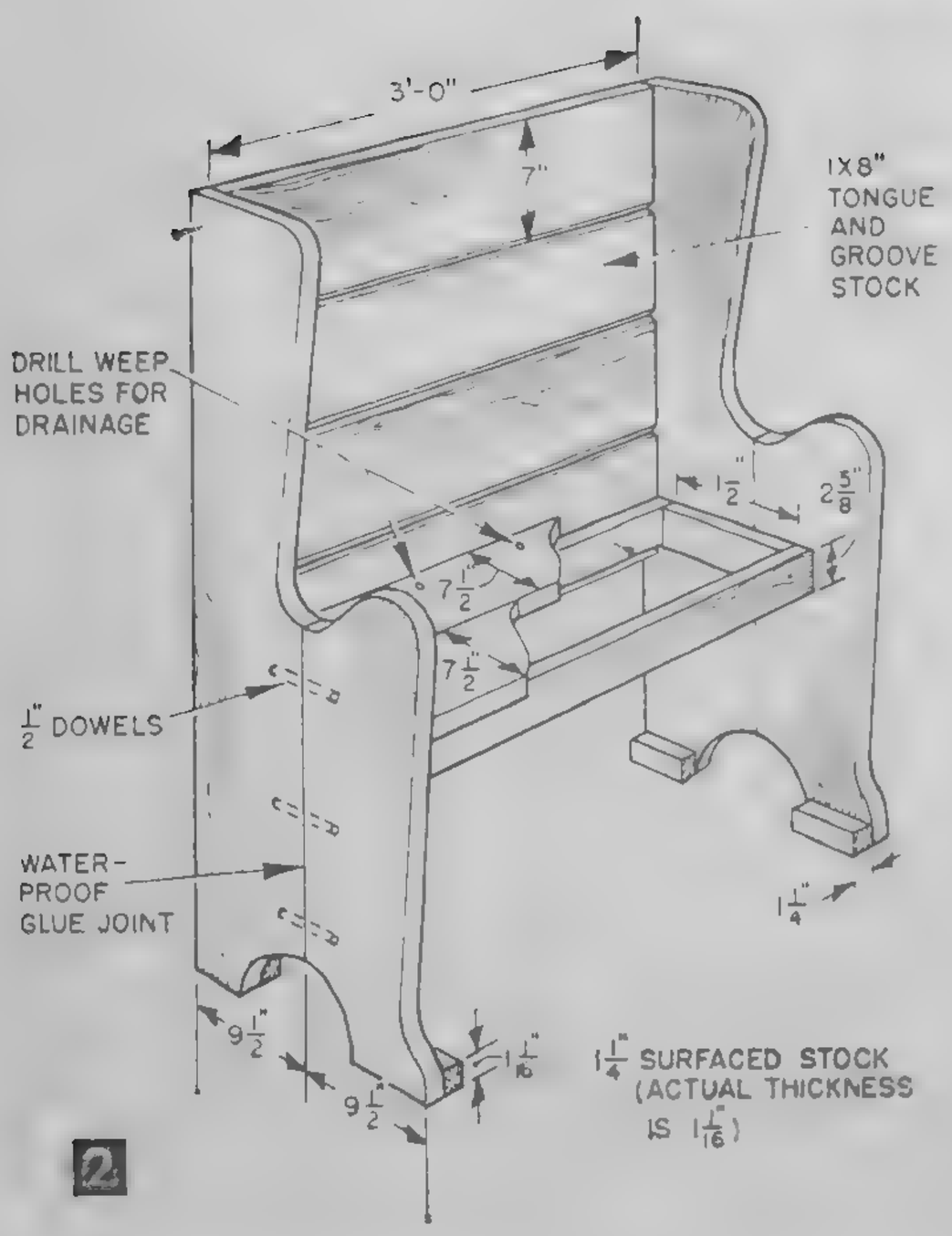
Now go over the parts, countersinking all holes 1/32-in. with an 82° countersink to remove all burrs at the edges.



Counterboring with boring bar for locating buttons on bottom of V-block. Note use of counterbalance on lathe chuck.



Dutch Colonial



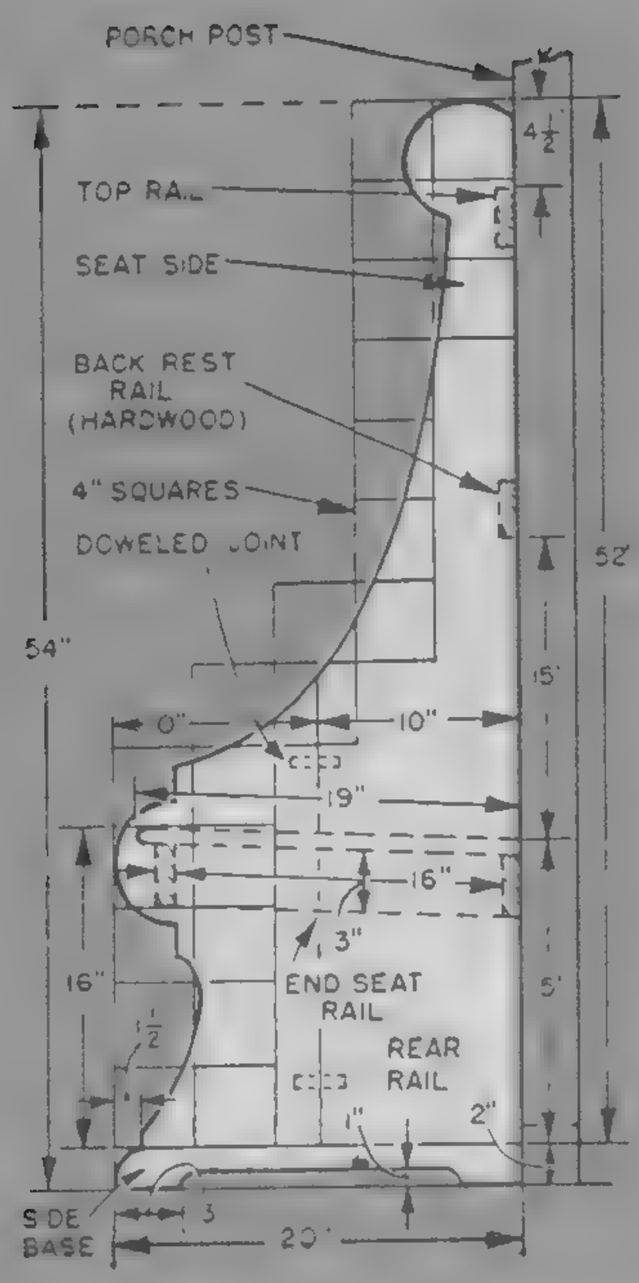
2

THE smooth sweeping curves of these graceful Dutch seats will add charm plus livability to the front porch of almost any frame house, as well as to many porches that have been added to brick homes.

Two designs are suggested. The simpler style (Fig. 1) can be used on one side of a deep porch, or as a twin design on a shallow porch. You'll find that the paired curves on each side will frame and emphasize the doorway. With a single bench, use the shelves (Fig. 3) with potted plants or decorative pottery. The shelf brackets repeat the curved shape of the bench for good artistic effect.

Your first step is to measure your porch floor. The width of the colonial seat depends on your porch size. Plan your dimensions so that the overall width of the seat plus ends is just right for a close fit between the wall, and the porch post.

For economy use pine lumber; it will be serviceable for years if you keep it well painted. A better, but more costly choice would be the heartwood of a decay resistant wood such as cypress or redwood. For a narrow seat about 4-ft. wide, 1½-in. thick surfaced lumber would suffice, but for wider

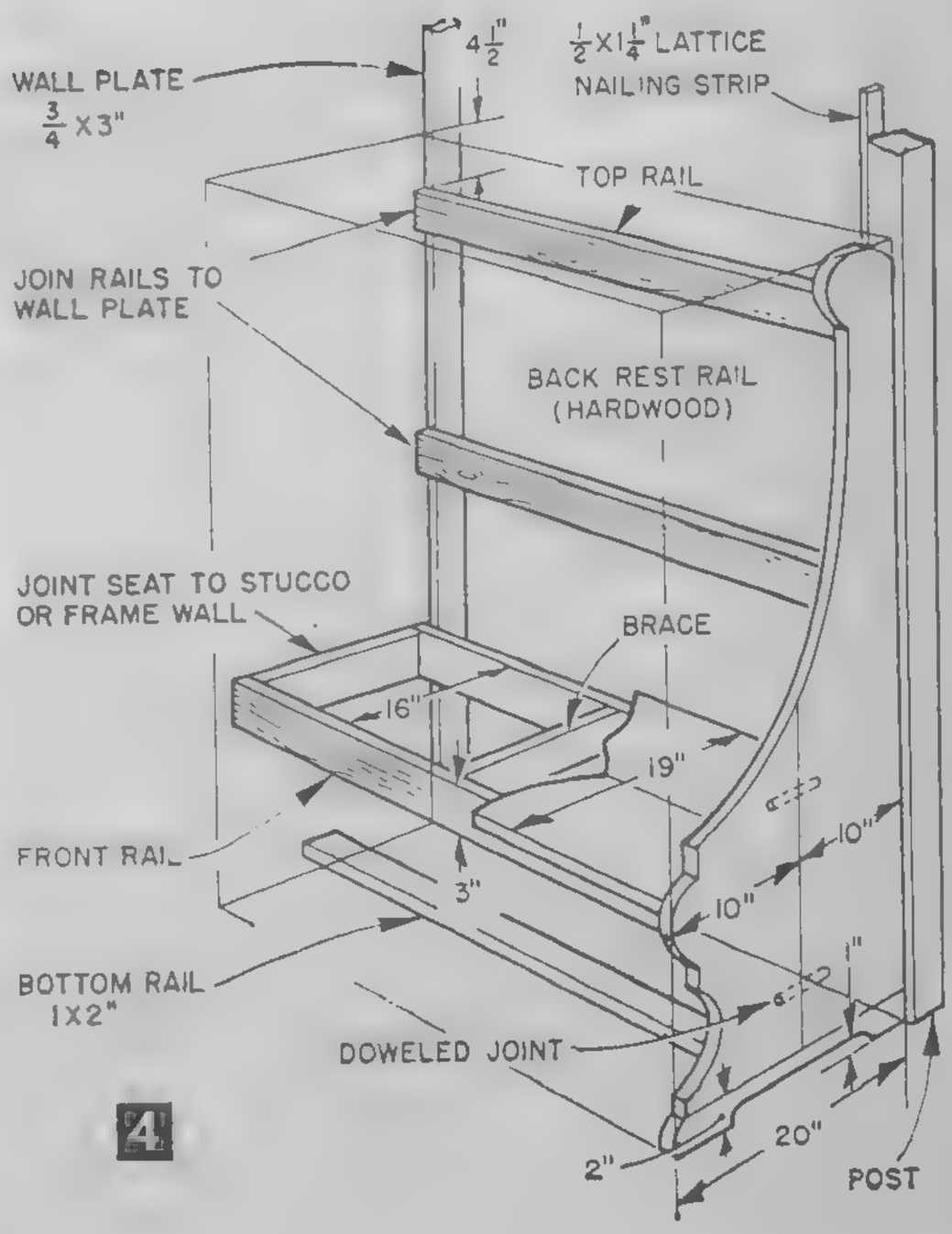


Seats for Your Home

seats use 1½-in. stock.

To draw the curves, lightly pencil 4-in. squares on the lumber (Fig. 2) as a guide. Saw the outline and sand. Use waterproof glue and rust resistant screws for assembling the joints.

On concrete porches, you'll want to anchor the bench permanently in place. Drill holes through the bottom cleats, mark the right spots and use a star drill and concrete anchors. Paint the finished bench to match the house, but be sure to undercoat first according to the paint makers instructions.



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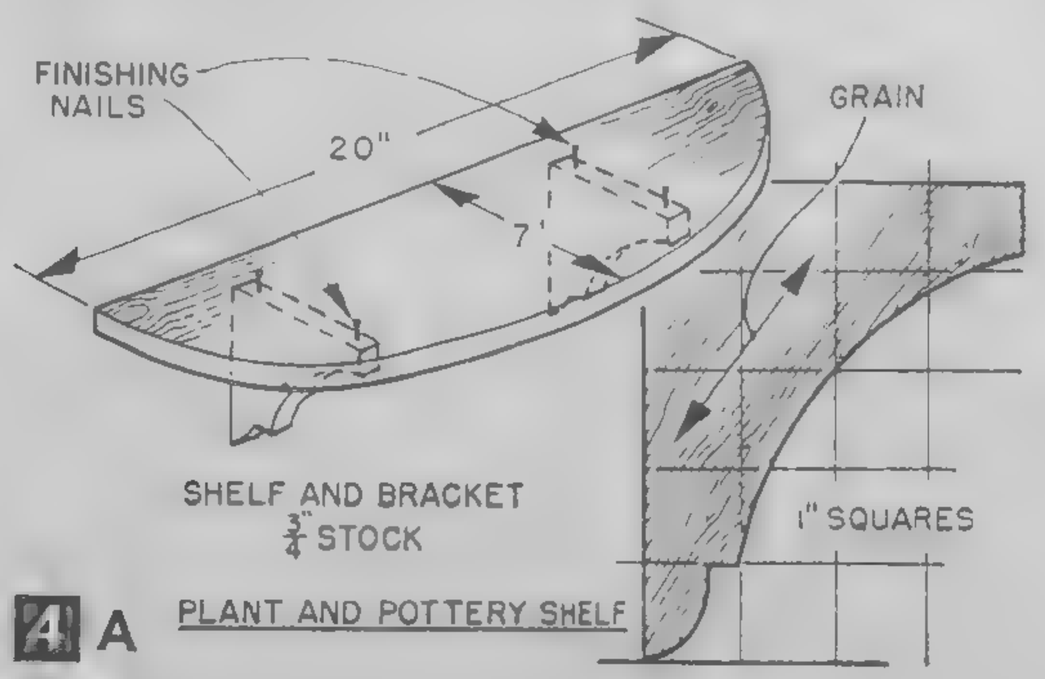


4 A

All Purpose

TOOL CHEST


1 A

New design overcomes usual tool chest drawbacks

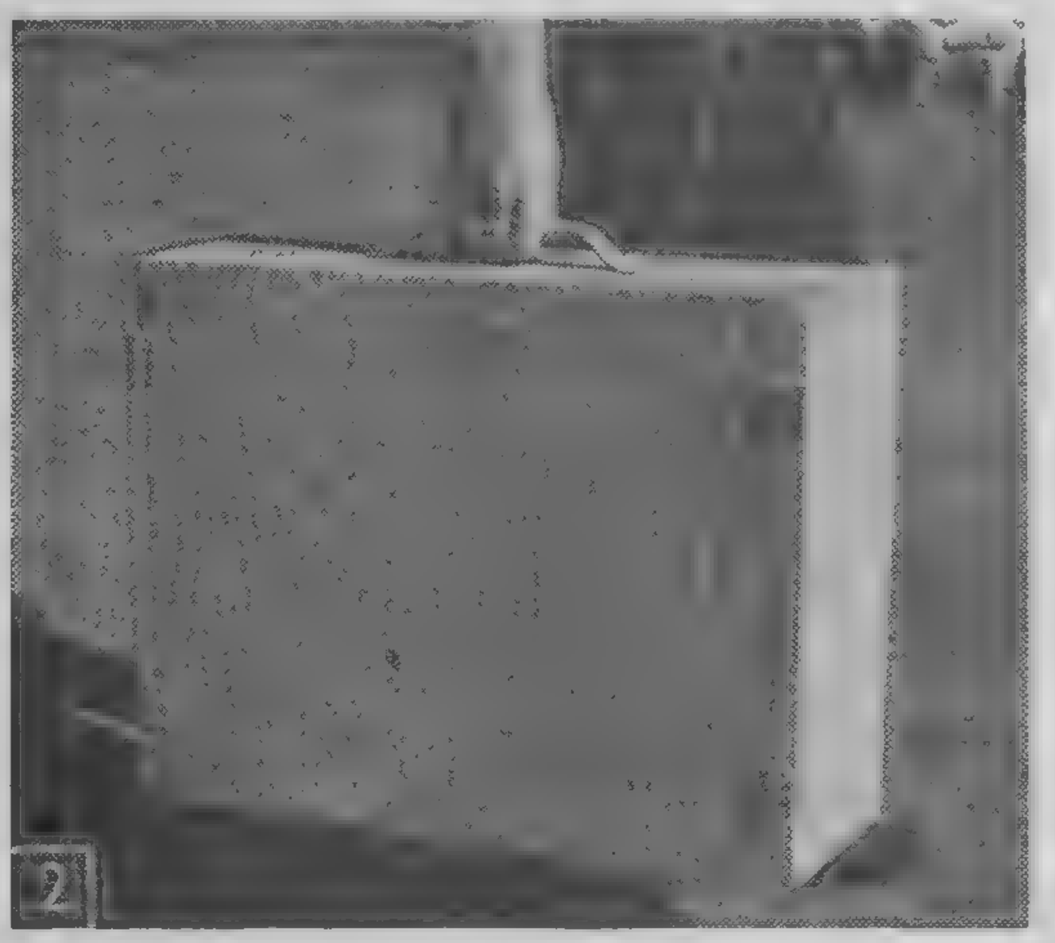
By R. J. DeCRISTOFORO

THIS new tool chest completely protects the sharp cutting edges of your tools. It serves as a shop tool cabinet, and you can also use it as a portable carry-all for location work.

Instead of carrying your tools loosely in a tote box or fumbling in the depths of the ordinary kind of chest, you'll find that this chest keeps your tools in order. They are easy to put away and easy to get out quickly. If you decide to take your tools out to the garage or summer home for a project, everything you need will be ready to go in one compact box.

The chest, set up on the end of a workbench or on a small table, will keep you from misplacing tools around the basement. Drawers provide plenty of space for small craft accessories, hardware, or electronic tools, and if moisture is a problem, you can add bags of silica gel or install a 15-watt lamp to fight rust.

Saw the top, bottom, and sides to size first. Rabbet both ends of the top and bottom and run the dado for the center divider (Fig. 4) right down the center of all three pieces. The right hand side piece also needs a dado for the center shelf of the small drawer compartment.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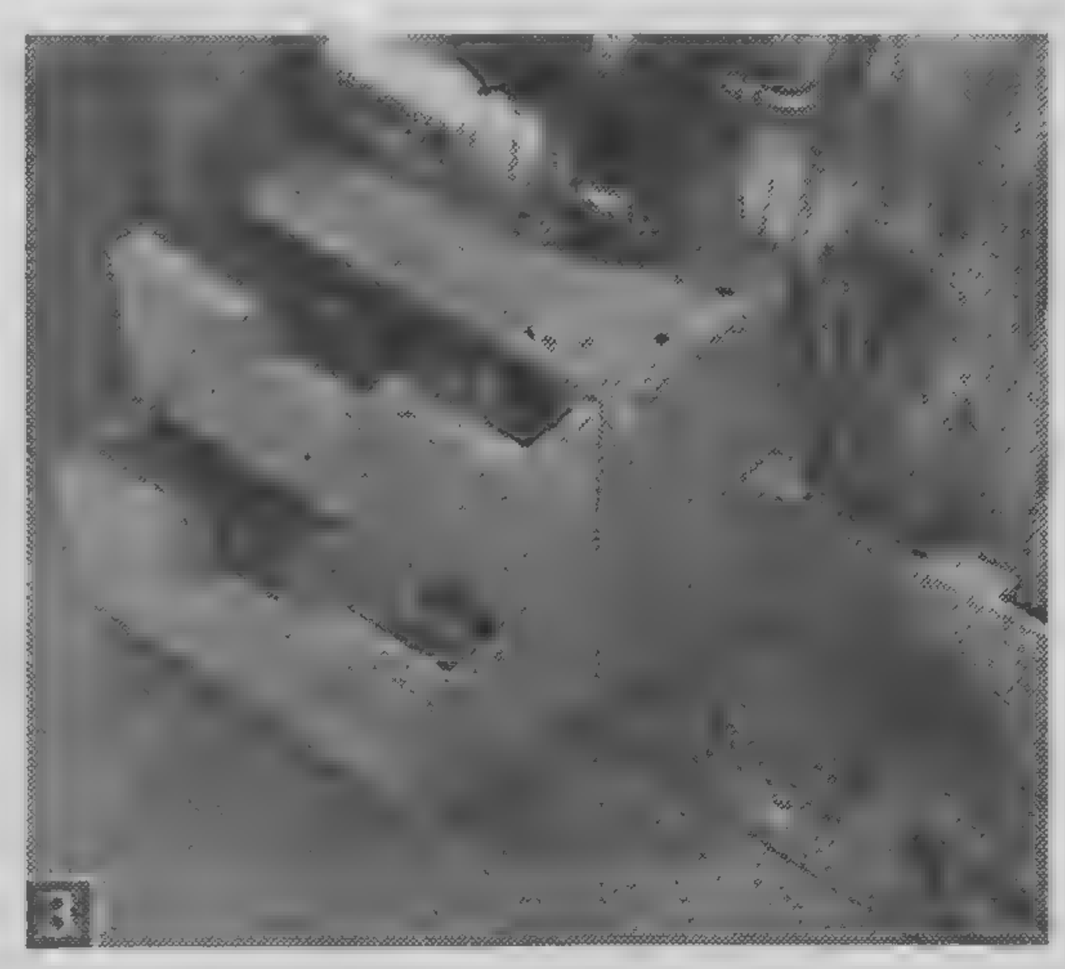
You won't climb Pike's Peak when this chest is loaded with 40 lbs. of tools, but the box is lighter than most metal chests of comparable size.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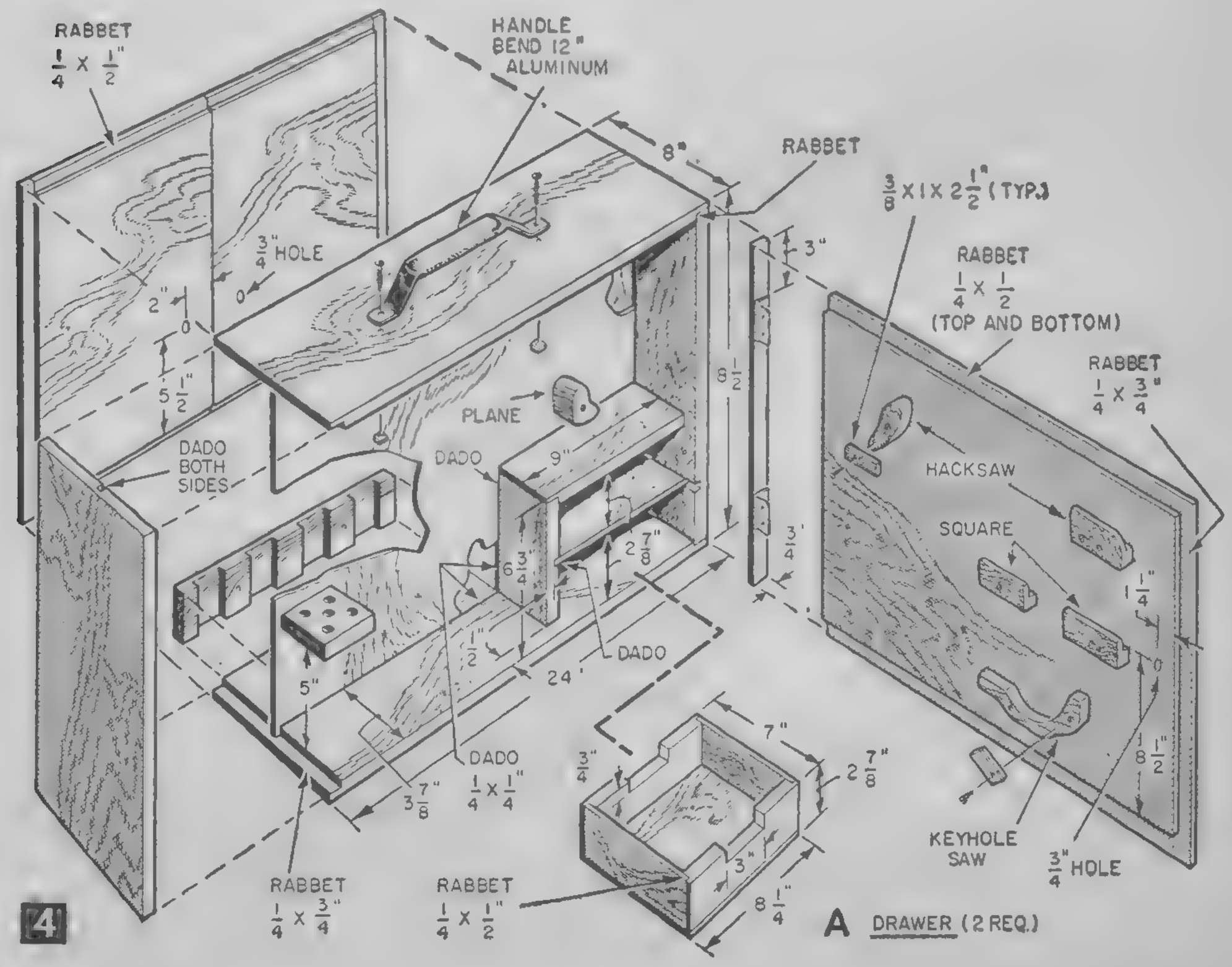
Reserve the drawers for drill points and small tools. With a little ingenuity you can fit any larger tool on the inside door panels and center divider.

The center wall gives you two chests in one. One side (A) can be used for common woodworking tools and the other side (B) to group plumbing and electrical tools.

Next, cut the parts for the drawer compartment. Nail and glue the right hand side to the bottom and add the drawer compartment. Then glue in the drawer shelf and the left side. Cut the center divider panel, making the cutout for the drawer compartment just a trifle oversize so you can trim after a trial fit to be sure you get a snug joint. Then add the top of the chest.

Make U-shaped cuts in both end pieces of each drawer to serve as finger pulls, and after the drawers are assembled, sand them for a good sliding fit. Next, add the three side strips, using glue and brads. Cut the doors to fit. When you hang the doors, be sure to favor the outside edge of the chest so they clear the drawers. Screws supplied with the hinges may be longer than the door thickness. If so, drive them home in undersize holes after dipping in glue and then file the project-



MATERIALS LIST—TOOL CHEST

Amt.	Req. Size and Description	Use
2	½ x 8 x 24" fir plywood	top and bottom
2	¾ x 8 x 18" fir plywood	sides
1	¼ x 18 x 23" fir plywood	center divider
1	¾ x 7 x 9" fir plywood	drawer top piece
1	¾ x 6½ x 7" fir plywood	drawer end panel
1	¼ x 7 x 8¾" fir plywood	drawer shelf
4	¾ x 2⅝ x 8¼" fir plywood	drawer fronts
4	¼ x 2⅝ x 6½" fir plywood	drawer sides
2	¼ x 7 x 8¼" fir plywood	drawer bottoms
3	¼ x ¾ x 18½" pine	door strips
2	½ x 11 x 18½" fir plywood	doors
1	½ x 18½ x 23¼" fir plywood	door
1	¾ x 3 x 3" pine	screwdriver shelf
1	¾ x 3 x 13½" pine	pliers rack
3	2" butt hinges	
3	spring-type cabinet door catches	
12"	aluminum tubing for handle	
Misc.	finishing nails, glue, spring catches, etc.	

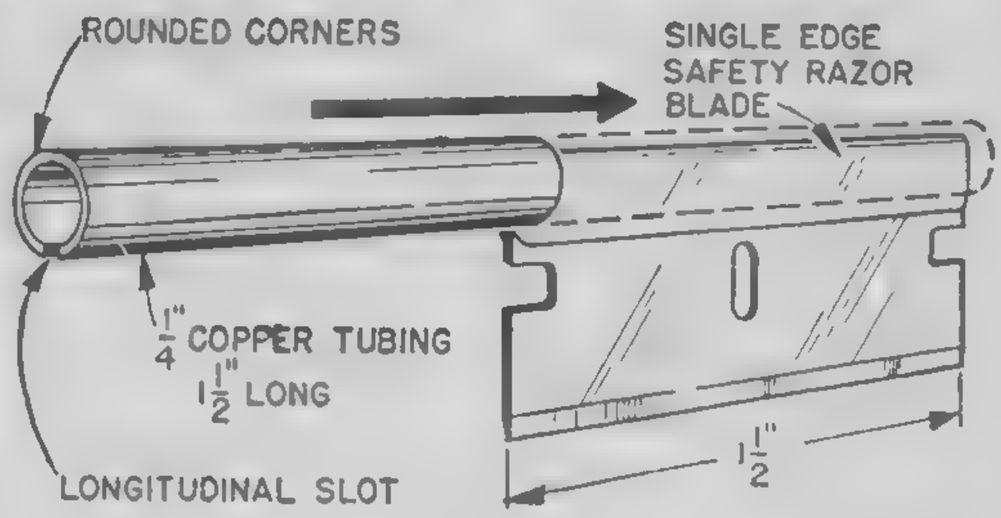
ing points flush on the inside. Be sure to allow clearance on the bottom edge of the doors so they will swing freely when the chest is set up.

Make the screwdriver-holding shelf and the pliers rack (Fig. 4) to fit your own tools. Simply cut wide dados in wooden strips to fit the handle width of your tools. Saws are best held on blocks shaped to fit the tool's grip, while hammers can be supported with spring-type catches available in hardware stores. Screw eyes and screw hooks will also hold many types of tools.

A carrying handle can be made by flattening the ends of a 12-in. length of aluminum tubing and bending it to shape. Or you may want to use a screen door handle. Paint or a few coats of resin-type sealer will protect the wood against dampness.

Better Grip for Razor-Blade Scraper

Adding some copper tubing to a razor-blade scraper makes for a more comfortable grip and reduces the danger of accidentally cutting your fingers.



TIRED of the finger fatigue and soreness that results from using a single-edged razor blade to remove unwanted paint from glass in newly-painted window frames?

You can ease it considerably by adding a small piece of ¼-in. copper tubing to the blade to make a more comfortable grip. Cut the tubing to the same length as the blade. Then, with a hacksaw, cut a longitudinal slot in it to hold the blade. Round-off the tubing on the ends with a flat file to eliminate sharp edges; a slight rounding at the corners of the cutting edge of the blade will lessen the chances of cutting into the window frame stock or chipping away particles of the putty sealer.

Spread or close the slot in the tubing so that the blade is gripped tightly enough to prevent its slipping while in use but also loosely enough so it can be removed easily when replacing it with a new one.—FRANK HEGEMEYER.

Touchup for Plasterboard

• Cutting plasterboard leaves shreds of paper and rough plaster edges which can be troublesome when two such edges must be joined.

For a better job, wrap some household screening around a block of scrap wood and use it on the cut edges as you would sandpaper.

Pro-Type DARKROOM SAFELIGHT

This sample safelight you can build yourself will give you all the darkroom light you need.

ANY professional photographer will tell you that a key accessory in his darkroom is a good safelight. It must filter properly, so as not to fog light-sensitive paper or film, yet be large enough to provide the necessary illumination.

The price of most large safelights on the market is stiff enough to make many amateurs shudder. But with an 8 x 10-in. safelight *filter*—which sells for only about $4.25 in photo shops—and less than a dollar's worth of other materials you can build a simple box-type safelight in a few hours.

Make the box sides and ends from ½-in. A-D grade interior plywood (Fig. 2). Smear the edges of the end pieces liberally with glue (which will help make a light-tight seal) and nail the sides and ends together, making sure that the edges butt squarely.

Next, drill a ⅜-in. hole in the center of one end of the box, 2½ in. down from the upper edge. Cut a 2 x 2-in. spacer block from ¾-in. pine and drill a ⅜-in. hole through its center. Glue the spacer block inside the box so that the holes line up.

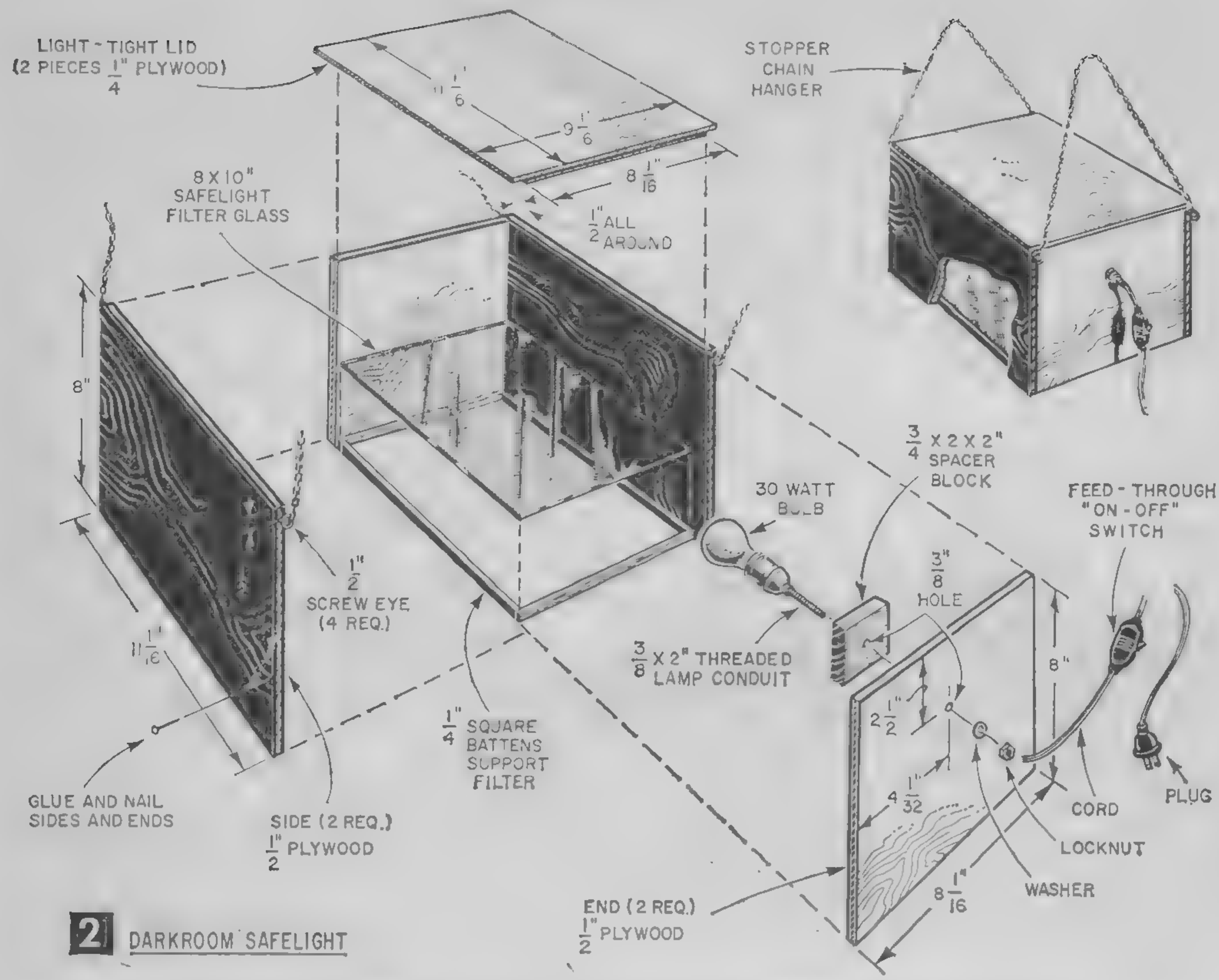
Now cut lengths of ¼ x ¼-in. pine for battens to support the filter (Fig. 2). Glue and nail two 8 1/16-in. pieces across the inside of each end of the box. They should fit snugly and flush with the bottom. Install two 9 1/16-in. pieces along the sides in the same way.

Attach a length of power cord to a threaded base socket and run it through a 2-in. length of ⅜-in.-diameter threaded lamp conduit. Screw the conduit into the socket and secure it with the small setscrew in the base. Thread the conduit through the hole in the box and fasten it with a flat washer and hex head nut. Then fit a feed-through on-off switch and plug to the cord.

Figure out how far down from the ceiling you want your safelight to hang and cut two lengths of stopper chain accordingly. Drill holes for ½-in. screweyes at each corner of the box, about ½-in. down from the top. Pry open the eyes slightly and screw them into the holes. Fit the end links of the chains over the screweyes and then crimp the eyes closed again.

Now cut the two pieces for the top from ¼-in. plywoood (Fig. 2) and glue and nail them together. To position them accurately, fit the smaller piece inside the top of the box, then turn the whole box over and place it on top of the larger piece.

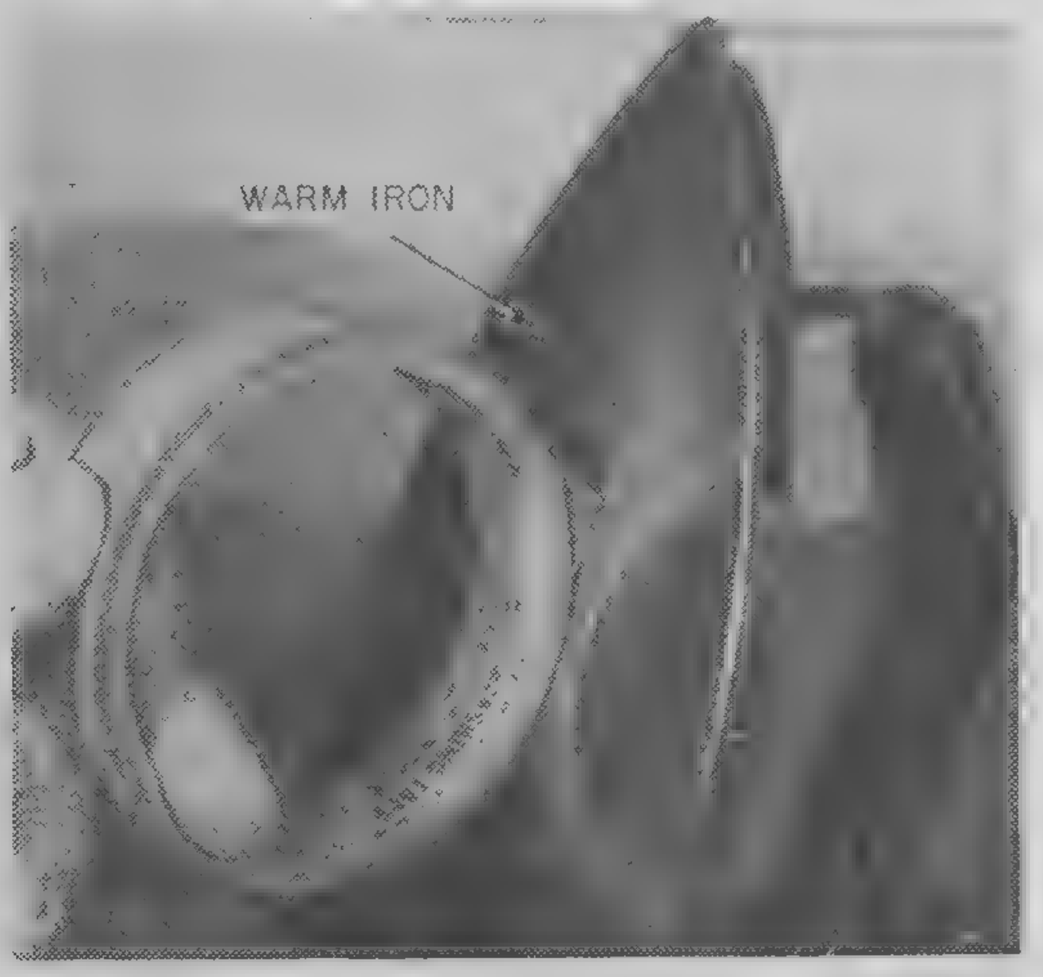
A coat of flat black paint will finish off the exterior of your safelight, and several coats of aluminum paint on the inside will increase its reflecting ability. Finally, slip the filter glass in, screw in a 30-watt frosted bulb, refit the top, and all that remains is to hang the lamp for use.—P. K. Snook



2 DARKROOM SAFELIGHT

Masking Tape Salvage

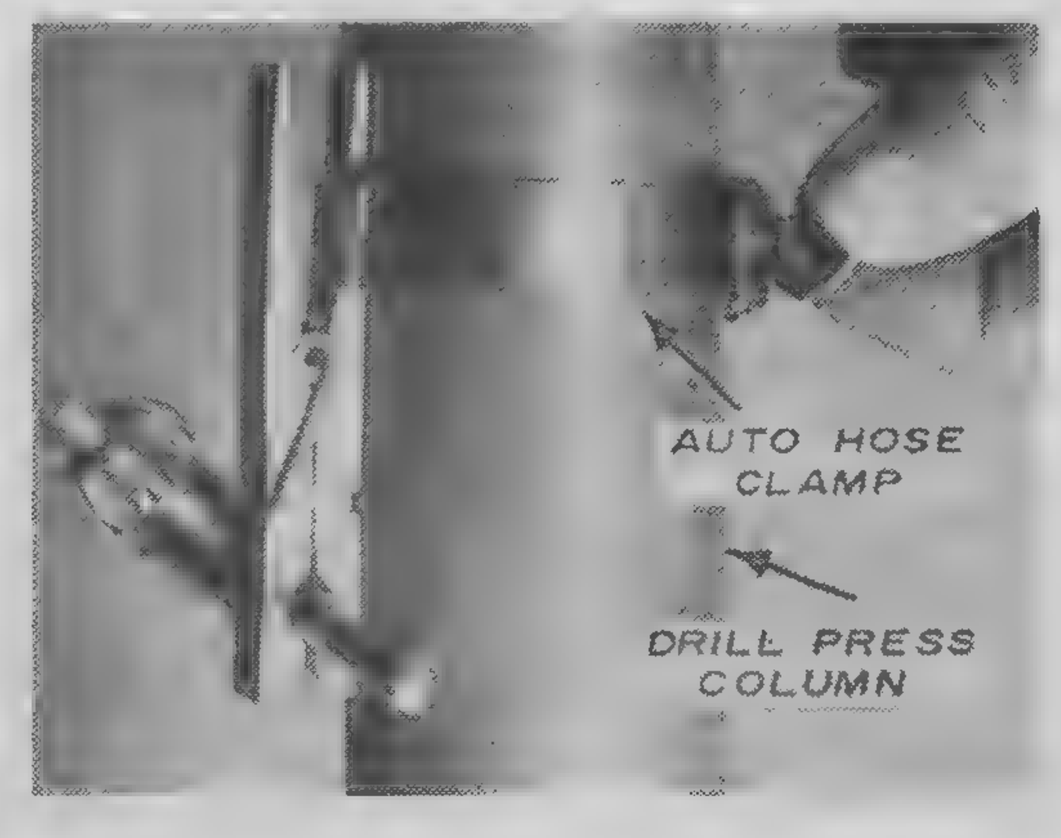
• If you have a roll of masking tape on which the last dozen or so turns have dried out and cannot be peeled from the roll, try this. Hold



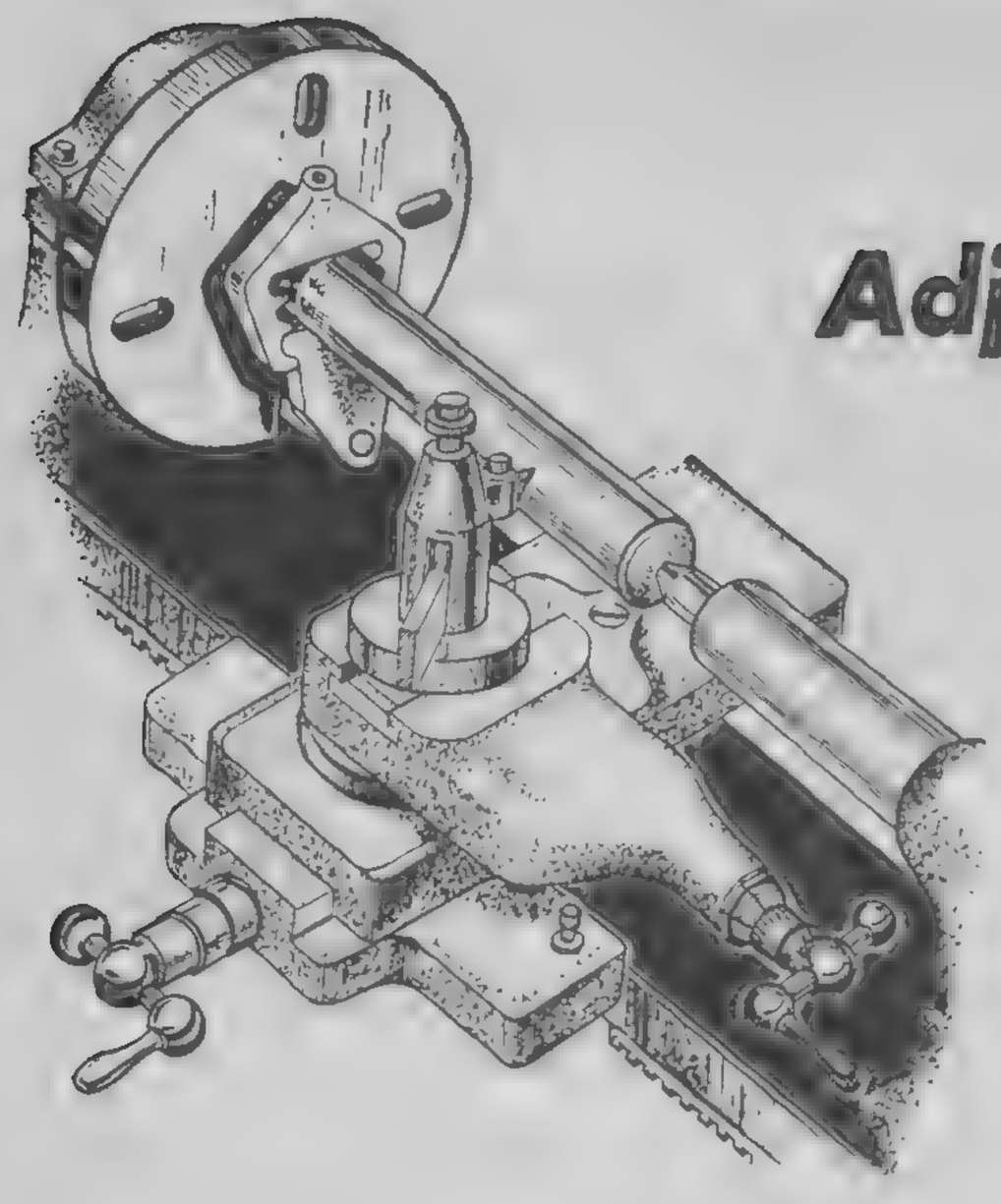
the roll of tape against the bottom of an electric iron that is set on "low." The heat will soften the tape's adhesive and allow you to unroll it.—KEN MURRAY.

Drill Press Tool Holder

• To keep a drill chuck key or other small drill accessories handy, just fasten a spring-type clothespin to the press column with an



automobile hoseclamp and clip the tools in the pin. Locate the clamp near the top of the column so it won't interfere with changing the position of the drill press table. Two or possibly three clothespins may fit under the same clamp.—GLEN F. STILLWELL.



Adjustable LATHE DOG

By C. W. WOODSON

TWO interchangeable tabs allow this lathe dog to drive bar stock of any shape. It will drive round work from ⅜ to 1¼-in. dia. and square or flat stock up to ⅞-in. Or the dimensions in Fig. 1 may be altered to make lathe dogs of different capacities.

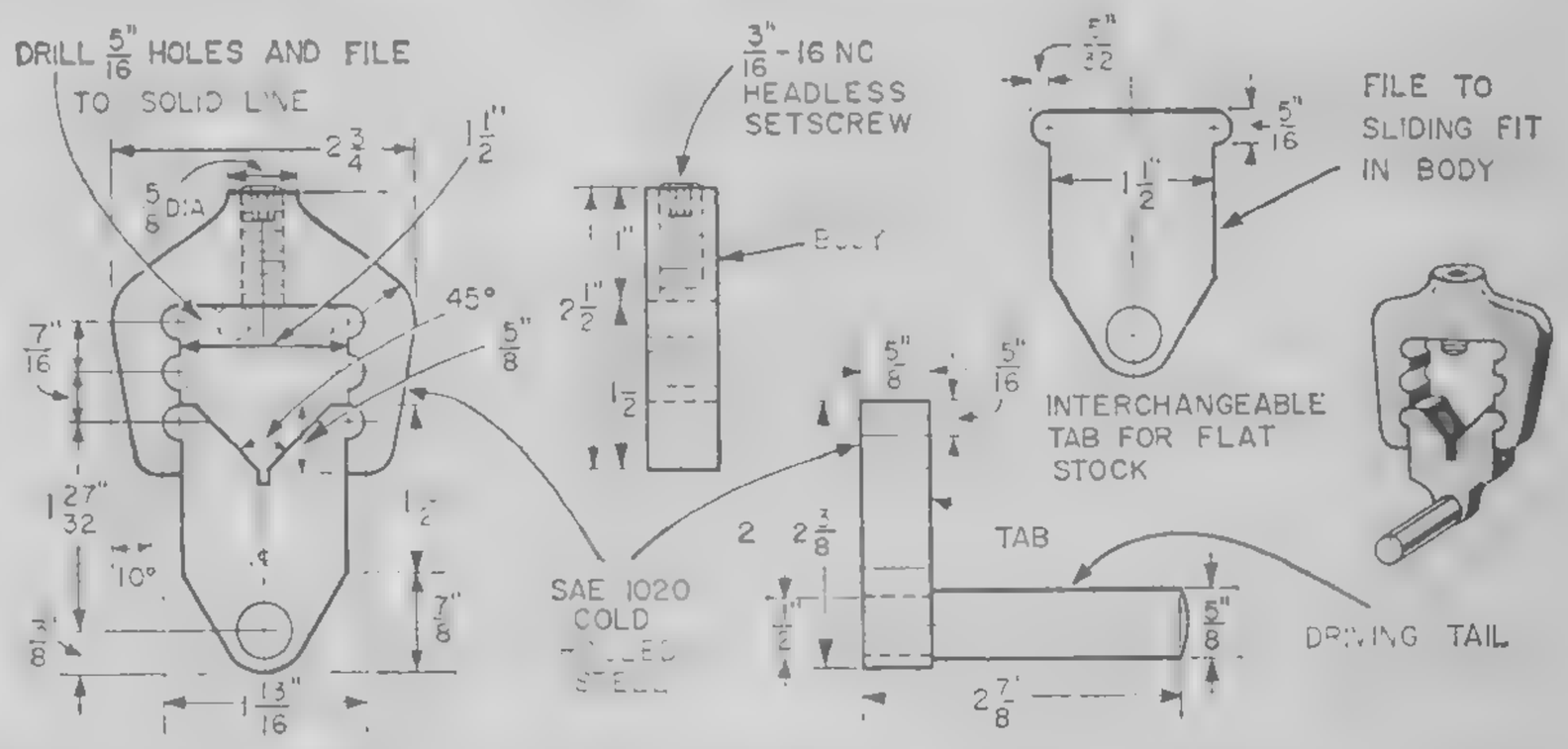
Use ⅝-in., cold-rolled steel, flat stock for the body and tabs. The driving tails are made from ⅝-in. dia. bar stock of the same material.

Lay out the body on a 2¾ x 2½-in. piece of stock. Mount it by the lower edge in a four-jawed chuck and turn the shoulders and the setscrew boss. While the body is still in the lathe, drill and tap it for the setscrew. Drill the 5/16-in. holes and cut the opening for the tab. Finish the opening with a file, being sure that the holes into which the tabs will fit are divided exactly on center. Now cut and smooth the beveled outside edges.

Lay out, cut and file the adjustable tab to be a sliding fit in the body, and make the 45° V-cut in the upper edge. A tool clearance slot is cut at the bottom of the "V" if it is to be finished on a machine. Bore the lower end of the tab to hold the driving tail. The tab for driving square stock is identical to this, except that the V-cut is omitted.

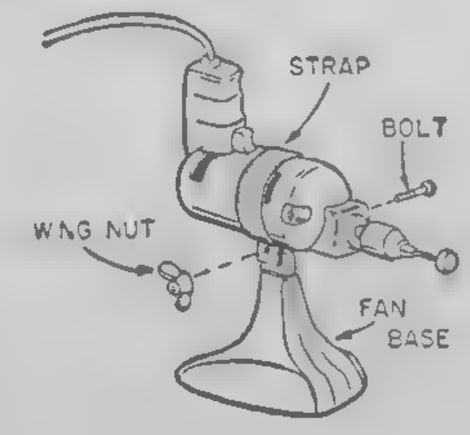
Cut the tail to length from the bar stock and turn a ½-in. dia. x ⅝-in. shoulder on it. Finish the shoulder to be a press fit in the tab.

In use, the body and tab are assembled over the work being turned. Set the tab in the notches that will make the lathe dog fit best. Insert the tail into the face plate and tighten the setscrew.



Adjustable Holder Angles Drill

• A discarded electric fan base makes an adjustable holder for your electric drill that will enable you to work with two hands, with the tool supported at any convenient angle. Make the strap of scrap tin, or sheet metal, and use a bolt and wing nut to fasten it to the base.—J. A. COMSTOCK.



Metal Fluxing Technique

• When soldering metal surfaces (especially aluminum), soldering flux is often needed to retard oxidation of the metal until the solder can be applied. A good way to apply the flux is to "charge" a wad of steel-wool with it and rub the metal surface briskly for several minutes. The rubbing produces a small amount of friction heat which melts the flux and flows it into the many tiny scratches in the metal made by the steel-wool. This fluxing technique roughens the surface and at the same time thoroughly saturates it with flux assuring a very good solder bond.

You need not get up for early phone calls, nor for your morning coffee—let your clock-radio start it for you—if you build this space-saving headboard.

King-Size

HEADBOARD

If you have insomnia, morning megrims (when you wish the boss would get lost) or if you are just plain lazy, this modern, Hollywood style headboard will put within arm's reach everything you need while you loll a-bed

By HUGH F. WILLIAMSON

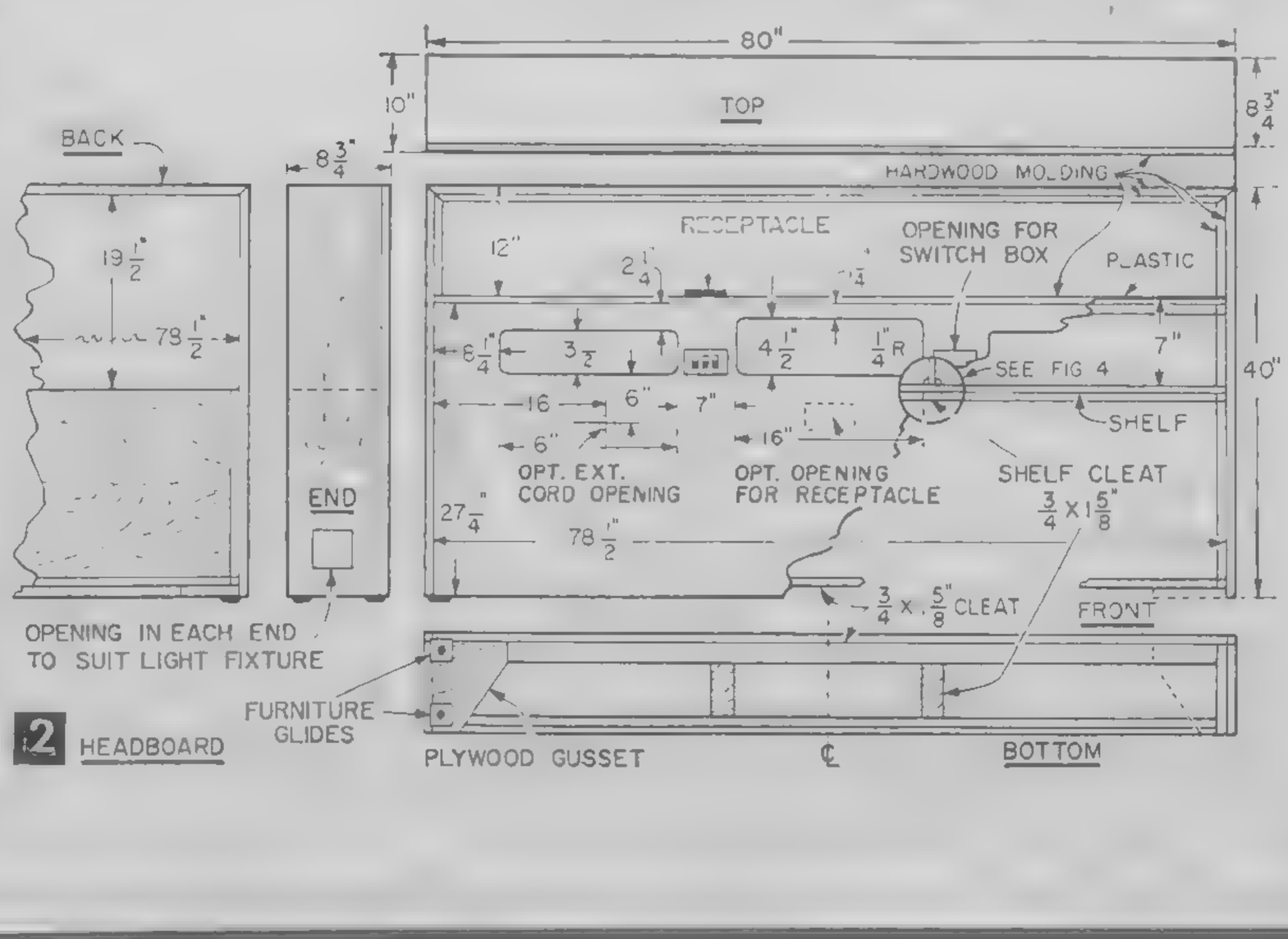
Styled to Blend With Any Decor, its full-length shelf provides space for books, telephone, clock, or radio; other items can be tucked out of sight in compartments just above mattress level. Built-in wiring takes care of floor-level night lights, electric blankets, fans, or other gadgets.

Although this headboard is dimensioned to fit two single-size beds made up as one, the design can easily be adapted to any size bed by making the over-all length just two inches more than your bed width. For example, a standard 54-inch double bed will require a headboard 56 inches long, so plan your material purchases accordingly. In this case, also, you would eliminate the center compartment and re-dimension the remaining two, locating the switches in between.

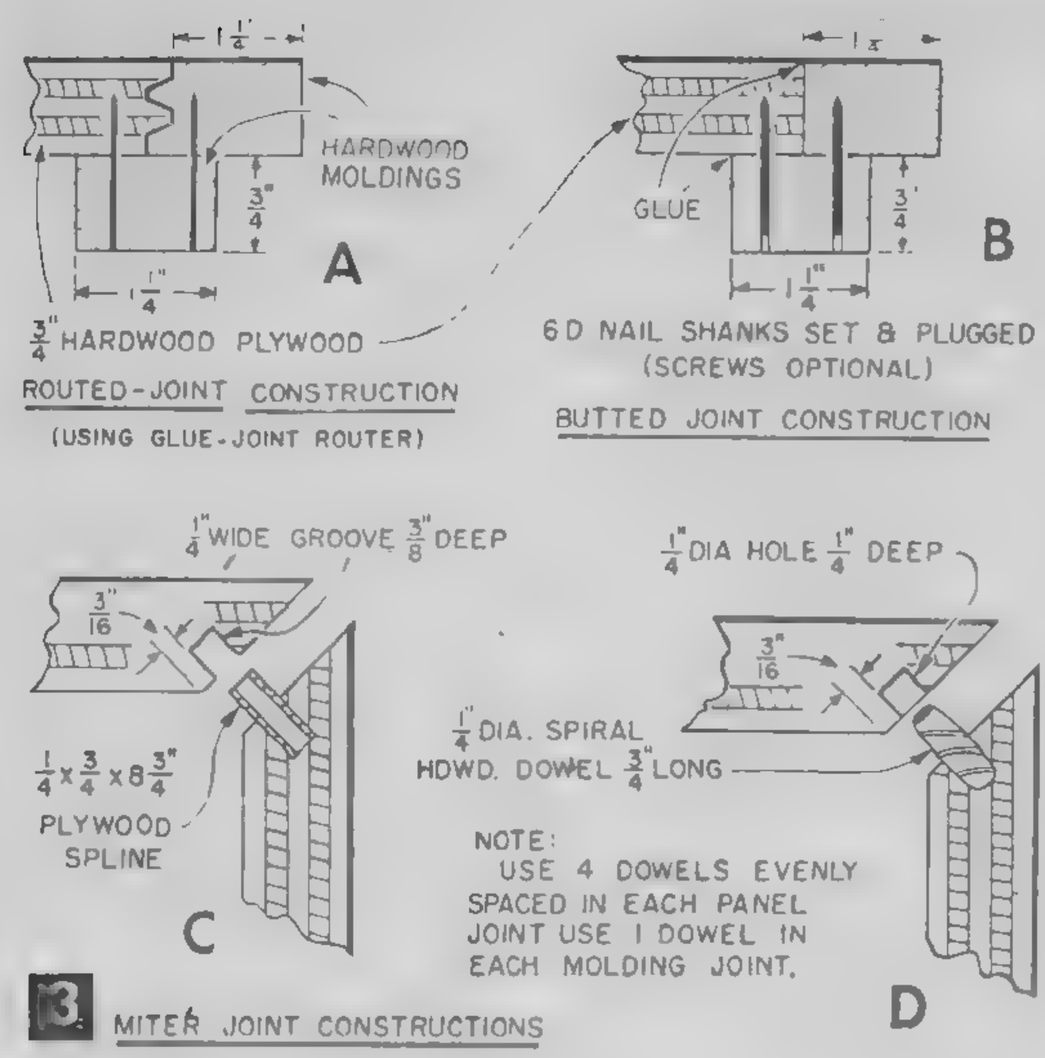
Construction is planned so as to require only hand tools; however, slightly more elaborate construction details are also shown if you have the required power tools.

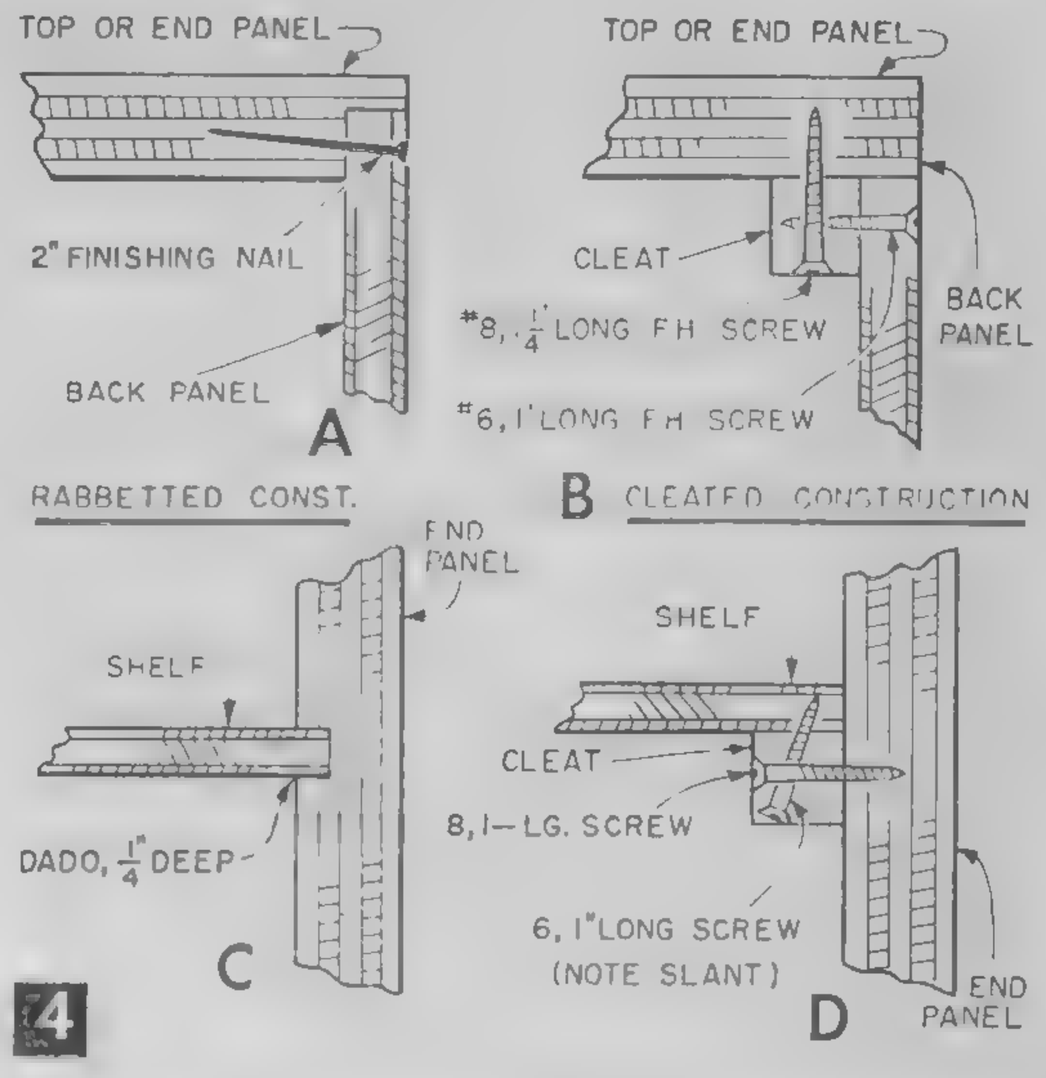
First Part of the Job is to cut the top, end, and front panels to size (Fig. 2). Then cut the compartment openings in the front panel and the night-light openings in the end panels. Smooth the edges of the compartment openings with medium, then fine grit sandpaper.

Cutting the 45° miters on the end and top panels is easiest done on the table saw, but can be done quite successfully by hand if



2 HEADBOARD





you are careful. Mark the line of the miter cut on *both* sides of the panel, and holding the panel horizontally in a woodworkers vise, saw carefully, checking progress of the cut frequently to be sure the saw is following the line on both sides of the panel. Then, to get a perfect fit, hold the mitered ends of the panels in the assembled position, and if high spots are evident, remove them with a wood rasp.

Decide now whether you will spline or dowel the mitered panel joints, then cut the spline grooves or drill the dowel holes. Dimensions for both methods are shown in Figs. 3C and D.

Also, if the back panel is to be rabbetted in, cut this rabbet now in the top and end panels (Fig. 4A). Note, too, that the shelves can be dadoed into the end panels. Cut these dadoes now if you choose this method (Fig. 4C).

The front edges of the top and end panels and the top edge of the front panel are finished with a plain hardwood molding chosen to match the exterior ply of these panels. An additional molding of the same stock is inset around the top and ends of the bookshelf, acting as a strength member as well as a decorative feature. Get out these moldings next. Miter their ends, and drill for the ¼-in. dowels (Fig. 3D). Detail A and B in Fig. 3 shows two methods of securing these moldings to the panels. Note that if the routed-joint method is selected, additional stock width must be provided on the edge-molding to allow for the depth of the routing. Width of the plywood panel is unaffected. Glue the edge moldings to the panels, clamping them securely until the glue is set. Add the inset moldings, glueing and clamping them, and fasten them additionally with the shank part of 5 or 6 penny coated nails, cut to 1⅛-in. length, and driven into pre-drilled holes, spaced 2 in. apart. Set the nails in about 3/32 in., and plug the holes with small whittled plugs of the same hardwood, glued in. Cut the plugs off flush with the surface with a sharp chisel. Be sure you back up the assembly with a smooth anvil when driving and setting these nails, to avoid breaking the glue bond. (#8 fh woodscrews,

MATERIALS LIST—KING-SIZE HEADBOARD

WOOD

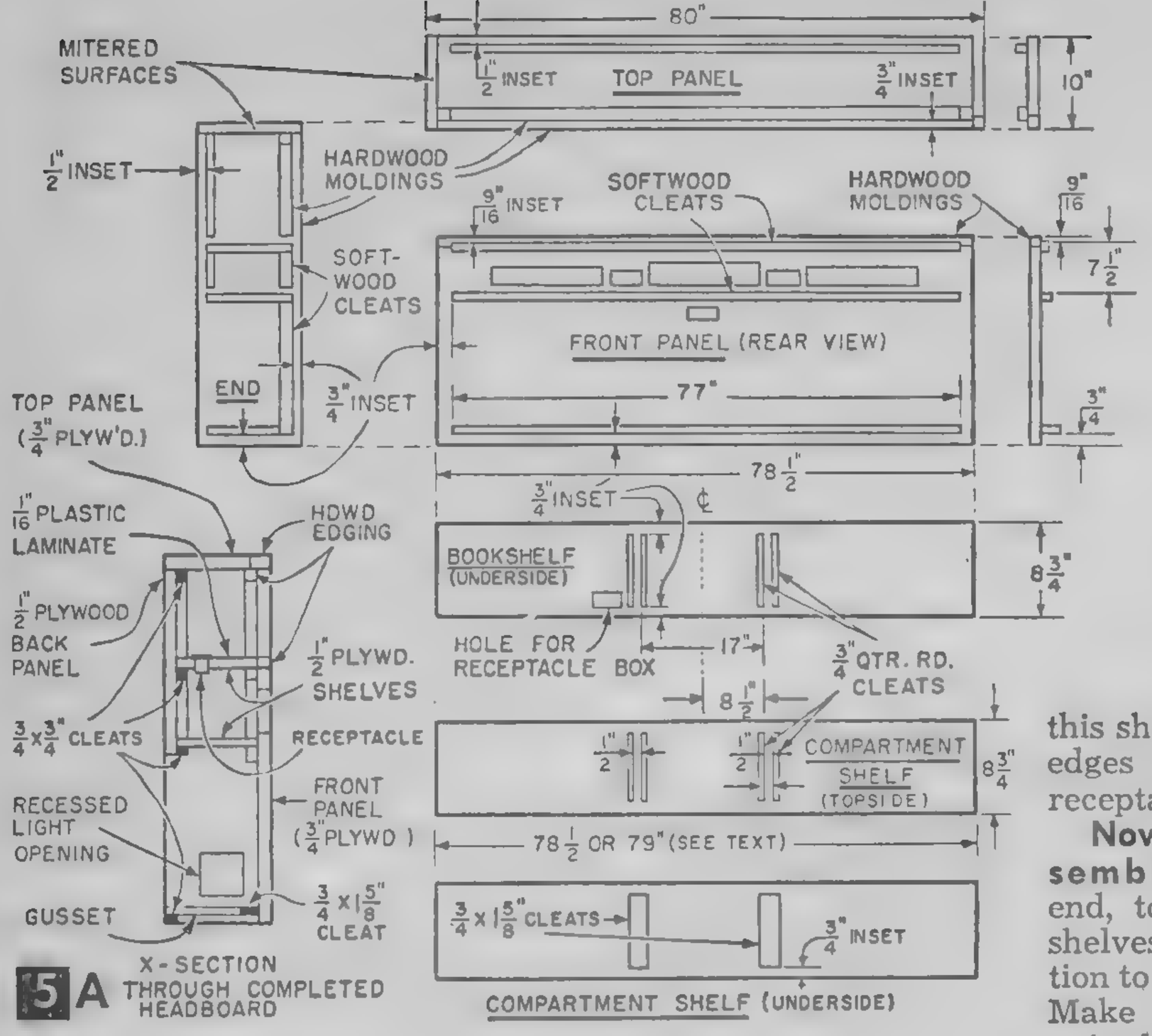
Amt. Req.	Description	Use
1	¾" x 4' x 8' sheet 5 or 7-ply hardwood plywood with one outer ply to match other furniture	top, front, and end panels
1	½" x 4' x 8' sheet, 3-ply fir plywood	backpanel, shelves
1	¾" x 5⅝ x 8' long hardwood plank, ripped to 1¼" strips (to match hardwood plywood)	moldings
2	¾" x 5⅝" x 8' long softwood planks, ripped to required widths	cleating
1	⅜" quarter round, 9' long	compartment divider cleats
1	¾" x 7⅝" x 20" long plywood or softwood	gussets

FASTENINGS AND MISCELLANEOUS

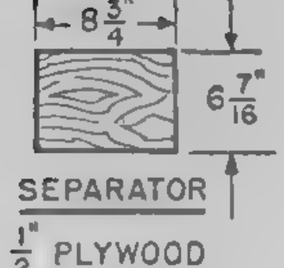
2 lbs.	6d coated nails	attaching moldings
2 gross	#8, 1¼" long, *fh* woodscrews	attaching cleats
2 gross	#6, 1" long, *fh* woodscrews	shelves and back panel
1 pkg.	¾" brads	compartment divider cleats
4	1" or larger furniture glides	bottom
	8¾" x 78½" plastic laminate, 1/16" thick	bookshelf
	woodfiller, paint, and varnish or laquer	bookshelf and outer surfaces

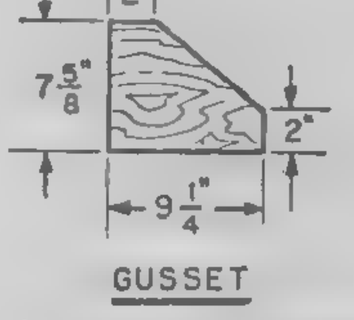
ELECTRICAL PARTS

2	convenience outlet boxes complete with duplex outlets and plates	wiring
2	2 switch boxes complete with duplex or triplex switches and plates	wiring
16'	sheathed 2-wire cable	wiring
2	recessed-type 6½" square single lamp fixtures	wiring
1 or 2	reading lamps, as desired	
1	110 V. "Lumiline" fixture, 40 or 60 watt (obtainable from Sears, Roebuck & Co.)	



5A X-SECTION THROUGH COMPLETED HEADBOARD





B

1¼-in. long, driven into pre-drilled holes spaced 4 in., may be used instead of nails.

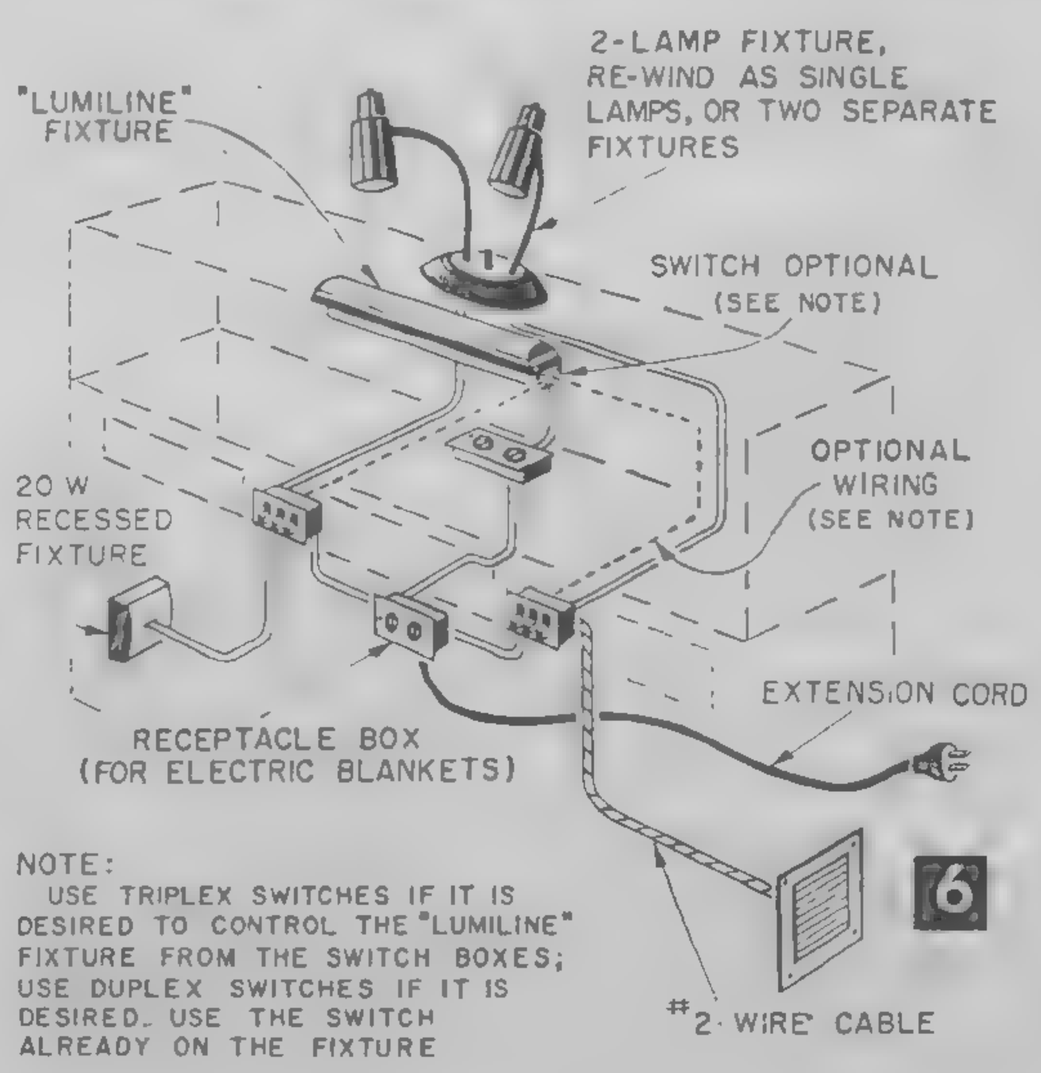
Next, Cut all Cleats to size and fasten them in place, following the cleating plan, Fig. 5. Note that all cleats are softwood, and all are ¾-in. x ¾-in., with the following exceptions: the front-edge cleats of the end panels and the top-edge cleat of the front panel are ¾-in. x 1¼-in., as these cleats help secure the edge moldings in place; the lower-edge cleat of the front panel is ¾-in. x 1⅝-in. to provide the extra rigidity needed here. Observe cleat gaps on end panels to clear shelves, and insets from panel edges to clear the back panel (½ in.), and the end and front panels (¾ in.).

Fasten cleats with glue and #8 fh woodscrews 1¼-in. long, spaced 4 in. The top-edge cleat of the front panel is located 9/16 in. down from the edge of the panel edge-molding; this is to allow for the bookshelf thickness (½ in.) plus the thickness of the plastic laminate. Make this same allowance when attaching the end panel cleats. Take pains with the upper ends of the rear edge cleats on the end panels (if you are using the cleated construction here), as these cleats will be visible at the back of the bookshelf; sand these cleats smooth and avoid scarring them when fastening them in position.

Cut the shelves out of ½-in. fir plywood, and cut the hole for the receptacle box in the book shelf. Apply the plastic laminate to this shelf now, trimming the edges and cutting out the receptacle hole.

Now Make a "Dry" Assembly, that is, clamp end, top, front panels, and shelves in their final position to check fit of the joints. Make corrections, if required, with a jack plane or wood rasp, until a satisfactory fit is obtained. Then clamp up the entire assembly, except for the compartment shelf, inserting dowels (or splines) and gluing all joints.

Get the two end panels absolutely parallel in this clamp-up. When the glue has set, finish fastening the cleats with #8 x 1¼-in. and #6 x 1 in. *fh* woodscrews, drilling the screw holes at a slight angle (Fig. 4D). The #8 screws are used everywhere except for securing cleats to shelving, where #6 screws



6

The completed headboard has storage space galore, and connections for electric blankets and other appliances. Bed frames are attached to the headboard with bolts or screws.

are adequate. Then add the required cleats (Fig. 5) to the compartment shelf, and glue and fasten it in position. Slide the compartment separators (Fig. 5A) into their grooves, and fasten the back panel in place with glue and #6, 1-in. long, *fh* woodscrews, spaced 6 in. apart.

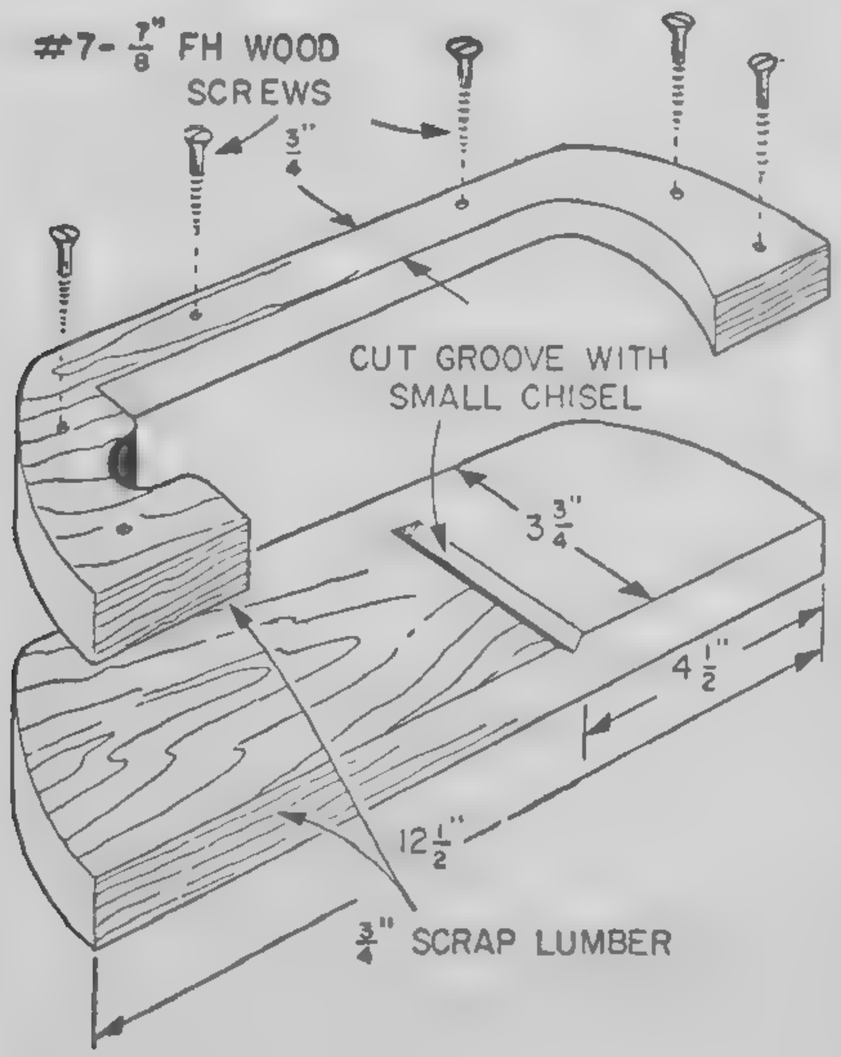
Make the gusset plates out of scrap ¾-in. fir plywood, or of ¾-in. x 7⅝-in. softwood (Fig. 5A). Fasten these in place with glue and #8 x 1¼-in. long *fh* woodscrews. Attach four large furniture slides to the bottom corners (Fig. 2).

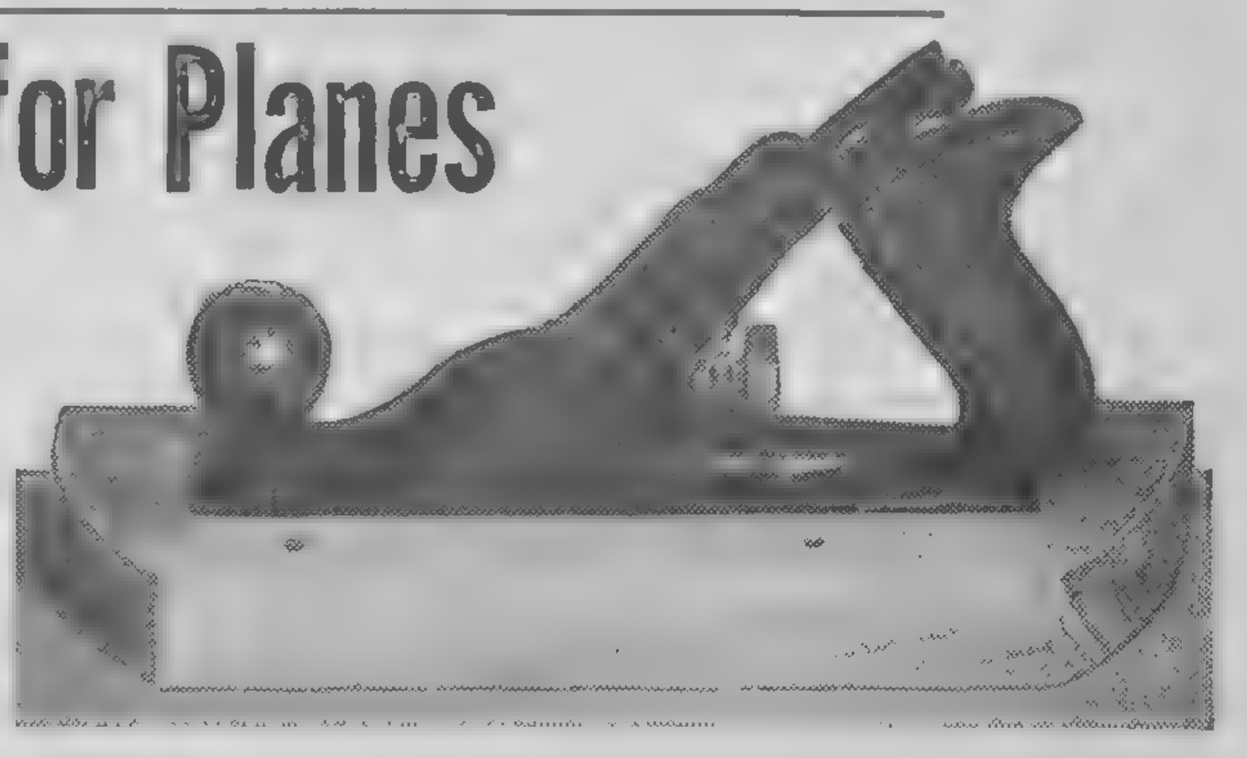
Now Install the Wiring following Fig. 6. In the original headboard, power was led to a receptacle box located under the compartment shelf, and the electric blanket extension cords were led through holes in the front panel to this box. An alternate method, shown in the drawings, is to install the receptacle box in the front panel beneath the center compartment opening (Fig. 2), plugging the extension cords in at this point. From this box, power leads to a second receptacle box in the book shelf, and from there to the individual switch boxes which control the night lights, reading lights and the "Lumiline" fixture. This latter may be controlled at the individual switch plates, or by means of a switch located on the fixture itself. The reading lights may of course be individual fixtures, or may be a re-wired two-lamp fixture similar to the one in the illustrations.

Finally, sand all surfaces of the headboard, finishing up with a fine grit sandpaper. Paint the interior surfaces above the bookshelf, and varnish or lacquer the outer surfaces.

The manner of attaching the bedframe to the headboard will depend upon the construction of your bed. Brackets, similar to those visible in Fig. 7, are obtainable for most Hollywood-style beds. These, or some similar kind, can be attached with screws directly to the front panel.

Wooden Shoe for Planes





KEEPING a plane handy and adjusted for immediate use while protecting the blade is the purpose of this gadget. Place the plane flat on a scrap of lumber slightly larger than the base of plane, with one side flush, and trace the outline of the other side and both ends. Saw out by hand or with a power band or jigsaw.

Nail this piece to another board and cut the two together to make the outside boundary of the shoe. With a small chisel cut a groove on the lower piece so the exposed blade does not hit board. Fasten shoe to a tool panel or simply place in a drawer or on a shelf.—CHARLES SMITH.

Portable Drafting Machine

By CARL W. BERTSCH

Use this portable drafting machine right in your workshop for on-the-spot designing of your favorite projects

The

CLAMPED to a regular drawing board or to a piece of plywood, this professional-style drafting machine is better than a T-square and triangles, letting you change quickly from one angle to another and return repeatedly to any setting with speed and accuracy.

You will have a very attractive instrument if you use brass for all the metal parts. Or you can use steel, finish it bright, and prevent it from rusting by coating it with a thin, clear lacquer.

Make the Head (Fig. 2A), using steel or brass, then drill the pivot hole in it and scribe the center line, but do not drill for the scale-attaching screws yet. Cut the pivot bars and crosshead bars out of strip stock. Bend one crosshead bar to fit over the other (Fig. 2B), then drill and rivet them together with two 3/32-in. iron rivets. After this operation is performed, clamp one pivot bar to one of the crosshead bars, and lay out and drill the two arm pivot holes, 3 in. center to center, without disturbing the clamp-up. Put a small scratch mark on these two parts before unclamping to identify them, then pair up and drill the other two. This guarantees that the arms in each pair will be parallel after assembly.

Countersink the arm pivot holes in the pivot bars and crosshead, noting that the crosshead pivot holes are countersunk from the upper face of one bar and the lower face of the other. Drill the attaching holes in the pivot bars, countersinking the ones in pivot bar #1 (Fig. 2C).

Make the arms out of 3/16 in. diameter brass or steel rod (Fig. 2D). Flatten and smooth up the ends, then drill the pivot holes, drilling the arms in pairs to insure exactly equal distance between the holes. Tap all these holes 8-32.

For the Scales, select two steel scales, such as those seen in Fig. 1, or two wood or plastic draftsman's scales. Attach them to the arms of the head with 8-32 *fh* machine screws inserted from underneath, through holes countersunk in the scales (Fig. 2A) and entering tapped holes in the head. It is essential, when attaching the second of these two scales, to get it exactly 90° to the first. Accuracy of your drawings will depend upon this.

Now assemble the machine, tightening up the pivot screws so as to eliminate all slack in the joints, and securing them with lock nuts. Drill the pivot and attaching holes in the protractor and mount it on the head. Last, make and attach the mounting block (Fig. 2C).

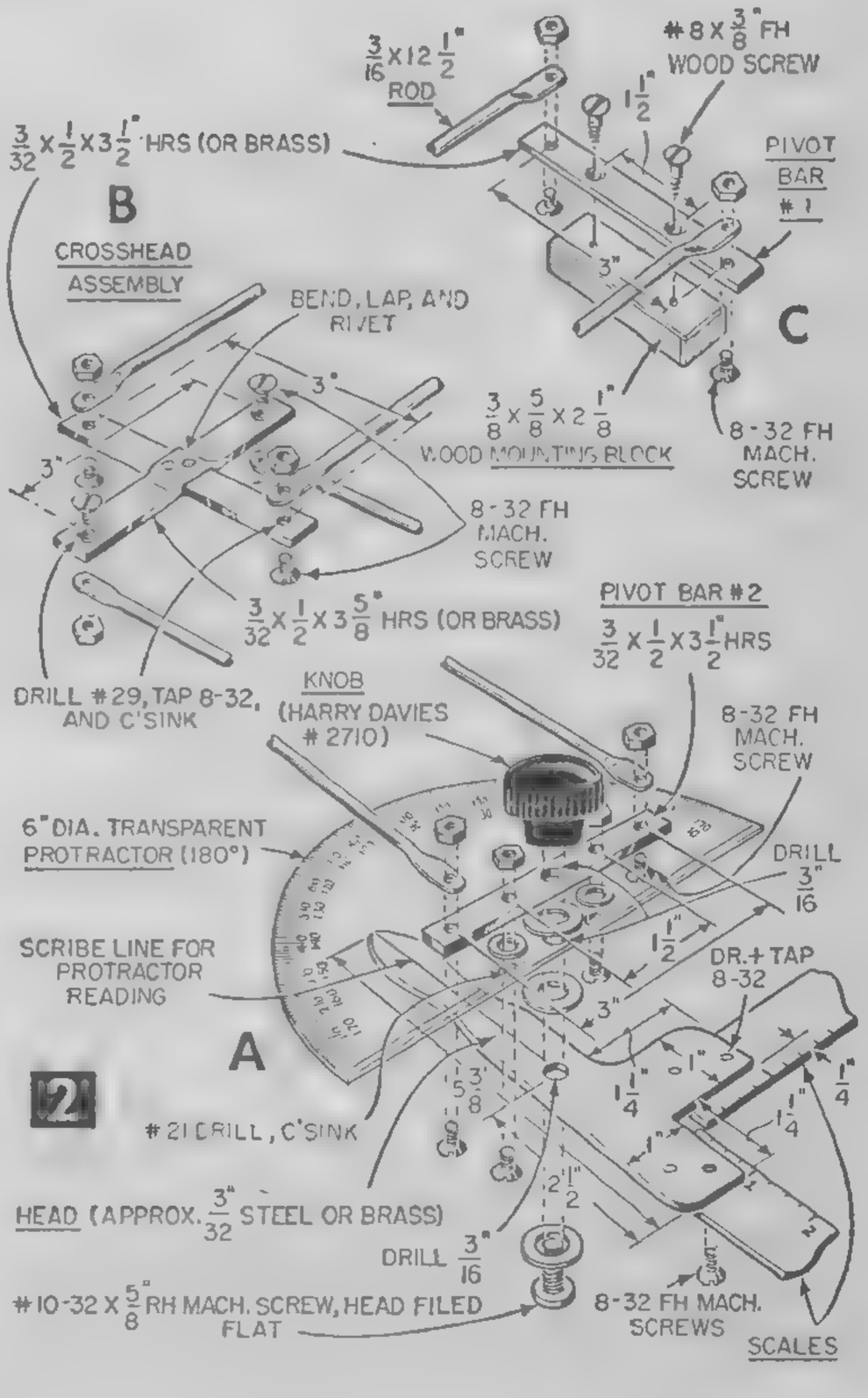
To use your drafting machine, clamp it near the upper left-hand corner of your drawing board (Fig. 1), selecting a position that allows you to move the scales over the greater part of the board. Tighten the plastic knob

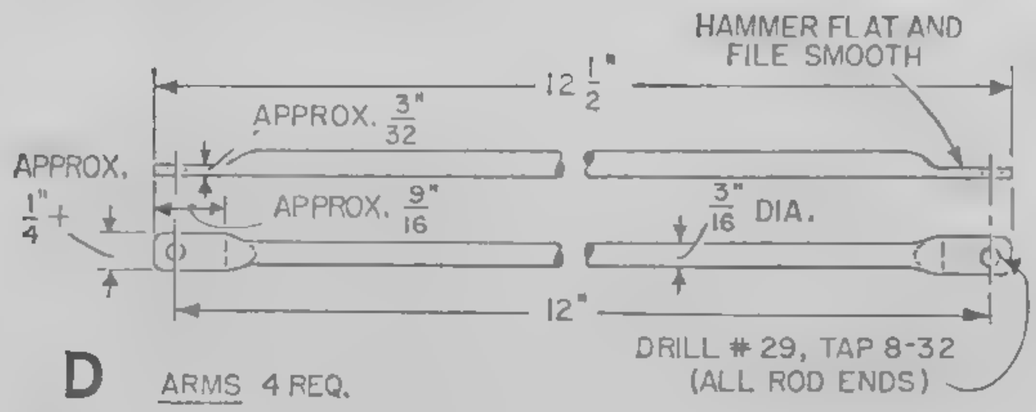
The clutter of instruments usually found on a drawing board is eliminated when using this versatile drafting machine.

with the scribed line on the midpoint of the protractor for ordinary drawing purposes, or at selected degree settings for angular drawing.

MATERIALS LIST—
PORTABLE DRAFTING MACHINE

No.	Size and description	Use
1	6" diameter 180° plastic draftsman's protractor	head
2	12" steel machinist's scales, or wood or plastic draftsman's scales	head
1	plastic knob, 10-32 internal thread (Davies #2710, obtainable from Allied Radio, 100 N. Western, Chicago, Ill.)	head
1	3/32 x 2 1/4 x 5 3/8" brass or steel sheet stock	head
3	3/32 x 1/2 x 3 1/2" brass or hot rolled steel strip	crosshead & pivot bars
1	3/32 x 1/2 x 3 5/8" brass or hot rolled steel strip	crosshead
4	3/16" dia. x 12 1/2" brass or steel rods	arms
14	8-32 x 1/2" *fh* brass or steel machine screws with nuts	pivots, pivot bars, scales
1	10-32 x 5/8" *rh* brass or steel machine screw	head pivot
3	3/16" brass or steel flat washers	head pivot
2	3/32" tinners rivets	crosshead
2	#8 x 3/8" brass or steel *fh* woodscrews	mounting block
1	3/8 x 5/8 x 2 1/8" hardwood	mounting block

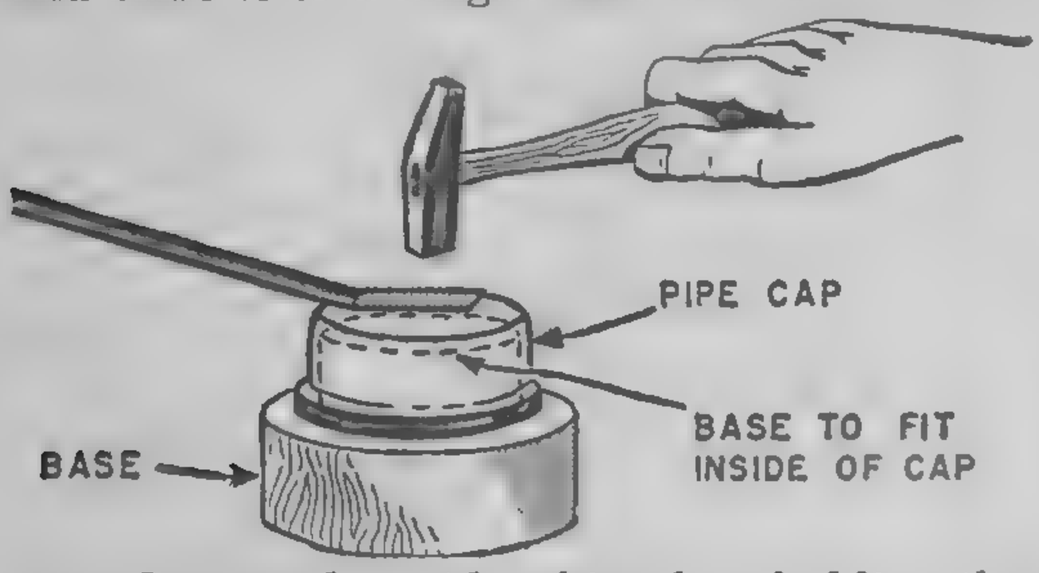




SHOP KINKS

Pipe Cap Is Bench Anvil

• A 1¼-in. or larger pipe cap can be used as an anvil for light work. Mount the pipe on a base turned or glued-up to fit inside the cap and raise it to a height that allows room for



your fingers alongside of it when holding the work. Polish the top of the cap if it is to be used for metal shaping, or leave it as is for ordinary nail straightening and riveting.

Mixing Trick for Paint

• Before storing a partially used can of paint, drop a bolt, nut, or a few marbles into it. When you get the paint out to use it again, just shake the can and let the objects inside do the mixing for you.—HAROLD HONEY.

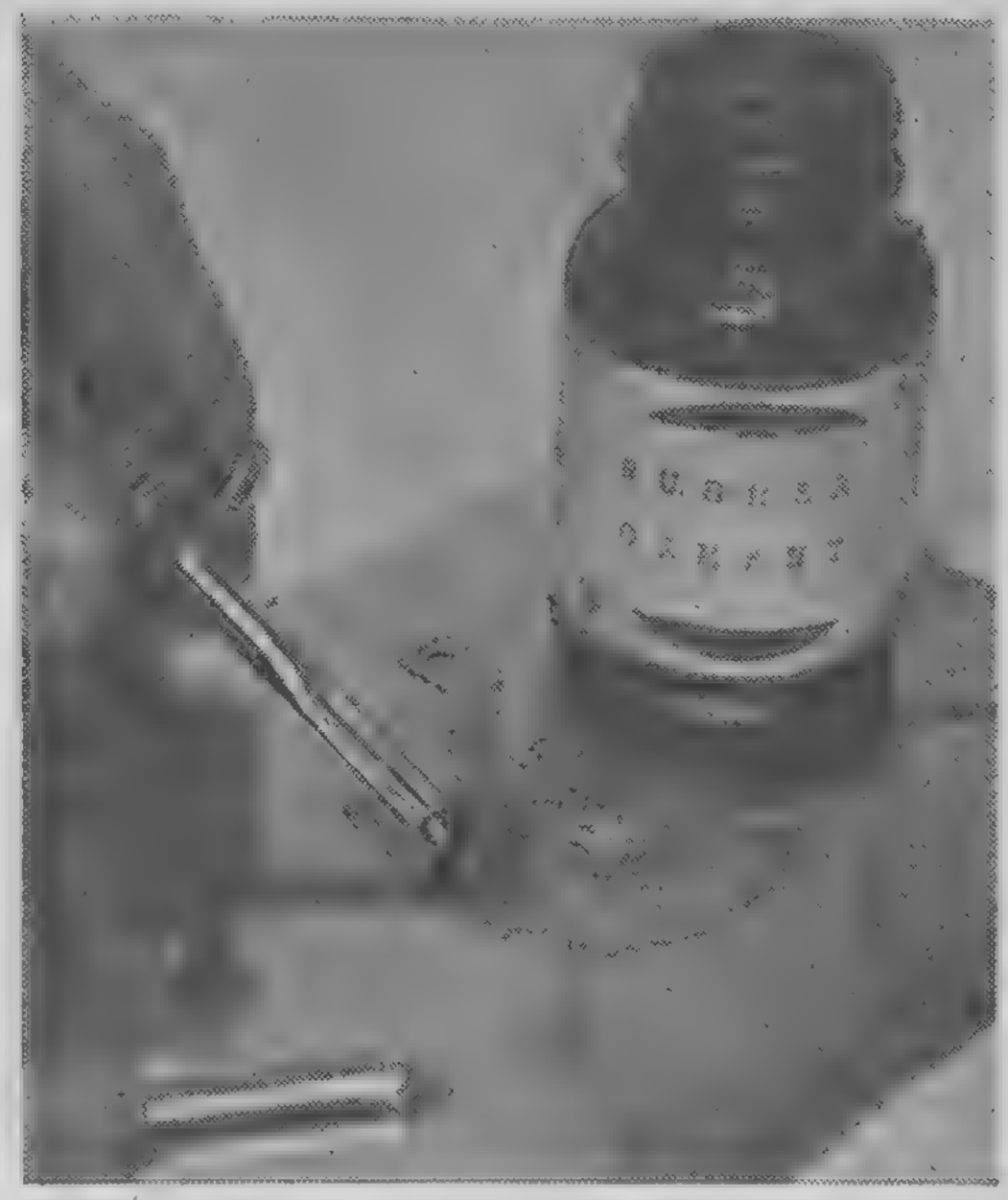
Clamp Squares Saw Cut

• A large battery clamp can be used to good advantage when hacksawing conduit or pipe. Mark the location of the cut on the pipe and then fasten the clamp over it at the mark so

it will guide the saw blade and give you a clean, square cut. The clamp also helps hold the work in a convenient sawing position.—JOHN A. COMSTOCK.

Cement Keeps Solder from Sticking

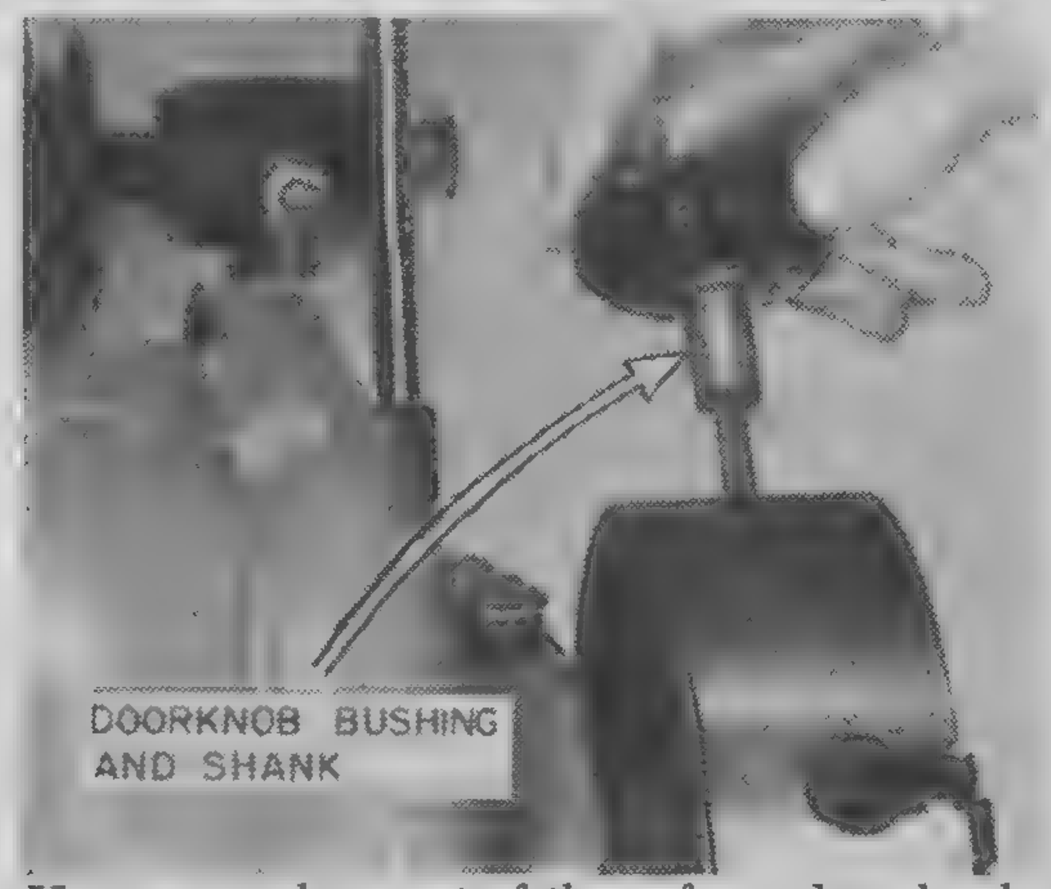
• To avoid having solder stick in an area where you don't want it, paint the area with



rubber cement. When the soldering is finished, simply roll off the dried cement and you'll have a neat appearing job.—J. A. C.

Door Knob Is Chuck Wrench

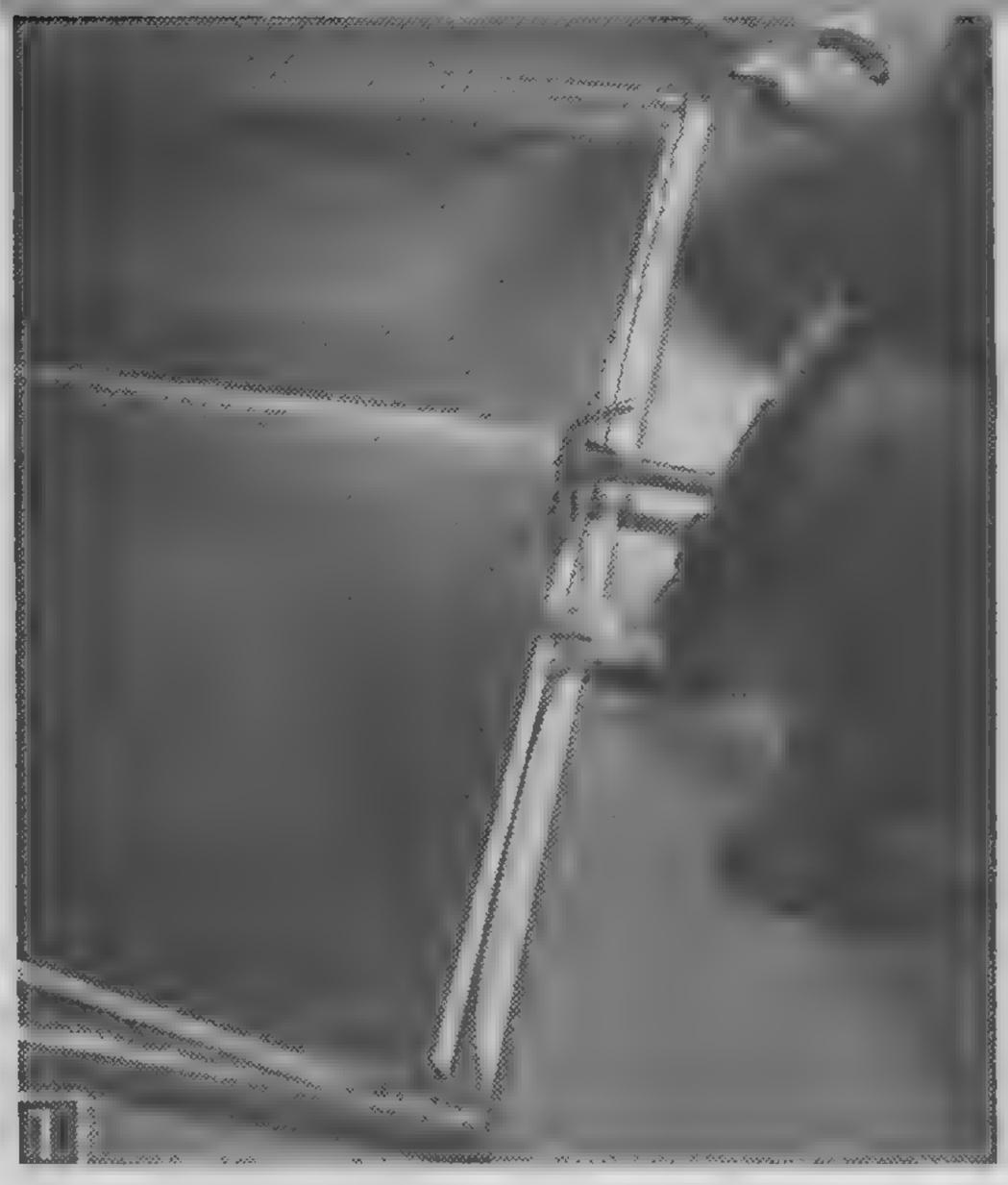
• When adjusting a four-jaw lathe chuck, it is helpful to have extra tightening tools to be used in pairs or along with the regular chuck wrench so the jaws can be positioned quickly.



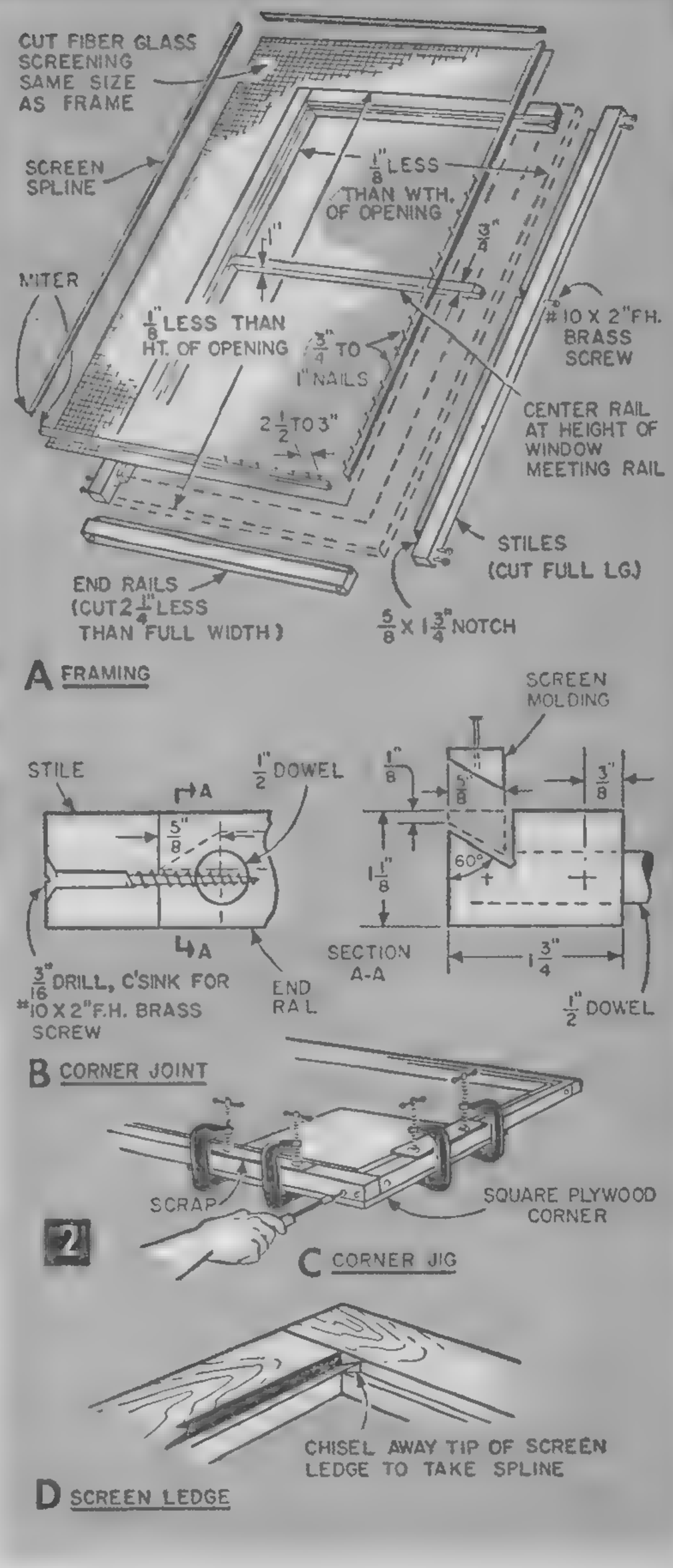
You can make a set of these from door knobs and spindles, cutting the square spindle to length and, if necessary, filing the tip so that it fits easily into the adjusting screw. With the knob in place, this tool can be handled easily and pairs can be made to be used on opposite jaws.—R. HANSCOM.

New Way to Make

Screens Built to Take It



Strips rabbeted from screen stock before assembly hold screening firmly over frame when they are nailed back in place to serve as molding. Nailing action forces wire to follow angled shape of the strips, pulling it tight.



IF NEW screens are needed next summer and you have access to a power saw, here is a simple, yet efficient, way to build durable frames that will give years of trouble-free service.

There isn't a tack in the new design (Fig. 4), yet you'll have to break the wire cloth before it will pull out from any rail or stile. Ordinary screen stock is used throughout for all framing and strips, and a quickly-rigged corner jig assures strong and accurate joints. We selected a fiber glass screening for its reflection-free, no-stretch properties.

Measure your window openings at outside edge of the screen stops, then deduct ⅛ in. from height and width for actual screen sizes. For each window, order screening within ½ in. of height and width, enough standard screen stock to cut out the top and bottom rails, eight to ten #10 x 2-in. *fh* brass screws (depending whether center rail is used or not), and an 8-in. length of ½-in. doweling. For every three screens which will have a narrow center rail, add width of this rail to your screen stock order. A ½-lb. box of copper or aluminum nails ¾ to 1-in. long and a quart of paint will be sufficient for the average job.

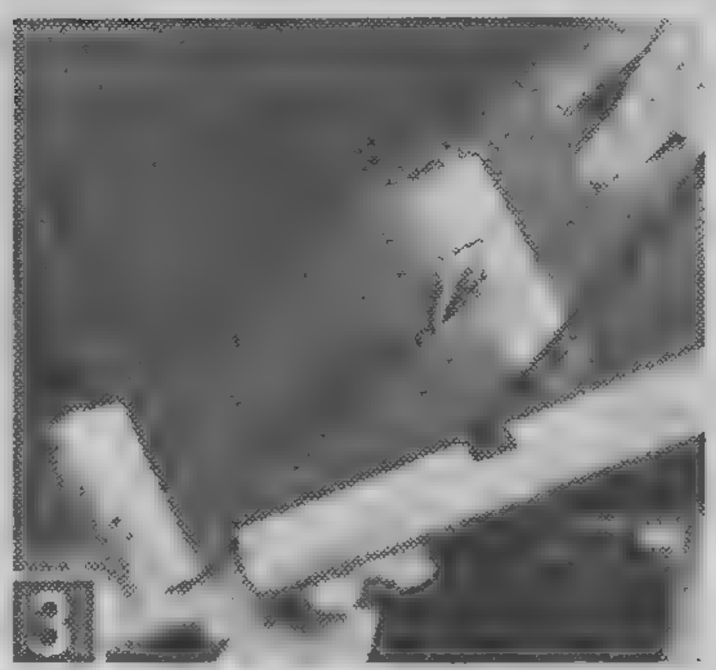
Begin framing by cutting the screen stock as in Fig. 2A, making all stiles full length and rails 1¼ in. narrower than actual screen width. Now set your saw table to cut a 60°

angle rabbet along inside top edge of all the pieces, as in A-A of Fig. 2B and Fig. 3. Be sure to use a narrow blade and save the cut-out strips for later use as molding.

Cut notches in the stiles for the end rails as in Fig. 2A, also for any center rail, which should always be aligned with the meeting rail of its window.

For an easy way to make strong corner joints, clamp frame members to a square panel cut from plywood scrap as in Fig. 2C. Doing one corner at a time, drill an end rail for ½-in. doweling and a stile for #10 screws as in Fig. 2B. Install dowel and fasten with 2-in. screws. The dowel will keep the long screws from pulling out of the end grain, making a much stronger joint. Install a center rail after outside frame is finished, one screw at each joint as in Fig. 2A.

Cut out any protruding wood on the rabbeted edges with a chisel as in Fig. 2D, then replace the strips temporarily to mortise the ends as in Fig. 2A. At this point, sand all framing and outside surfaces of the strips. Then paint them to suit your home exterior.



Above, saw table set to cut the acute-angled rabbet in edge of screen stock with a 1/16-in. ply tooth circular blade.

Right, finished screen, ready to install.

Now lay screening over a frame, line up a wire strand with inner edge of a stile, and replace the strip previously rabbeted from this edge. Beginning at the center and working toward ends, nail strip through wire into frame as in Figs. 1 and 2A. Repeat the process with an adjoining strip. Nail up remaining strips after pulling screening taut.

When all moldings are in place, cut away excess screening on outside edge of the molding with a razor blade or utility knife. Dot the nail heads with matching paint, and your screen is ready for the window hardware and installation.—DAVE SWARTWOUT.

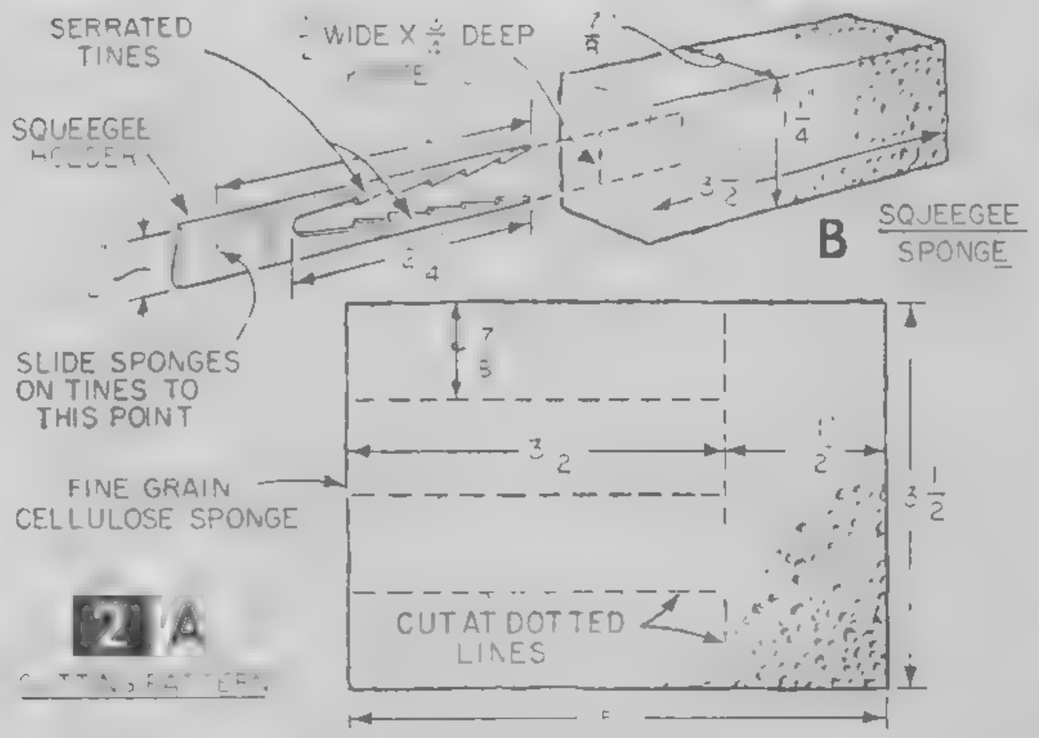
Replacing Old Sponges on a Photo Squeegee

DON'T throw away that photographic squeegee when the sponges become soiled or no longer remove wash water from film.

You'll save by buying a fine grain cellulose sponge at your camera store, from which you can cut adequate replacements (Fig. 1) in minutes, provide yourself with two spares, and still have a usable piece left.

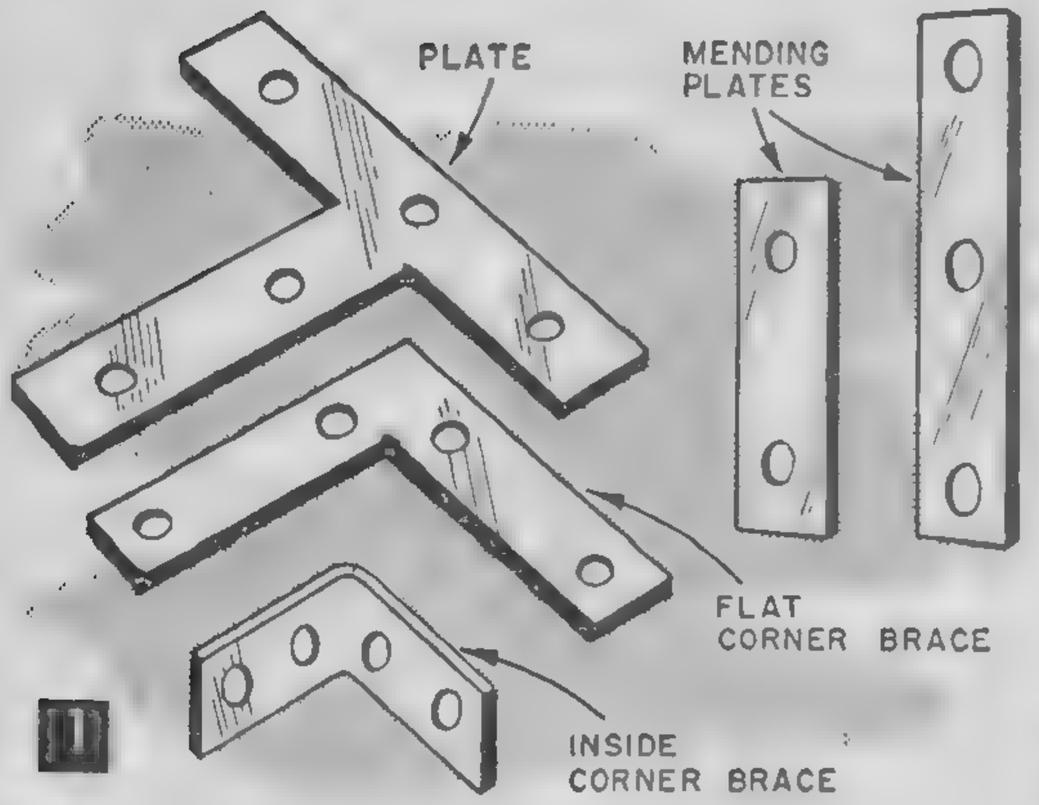
Obtain the 1¼ x 3½ x 5-in. size and cut it into five parts as in Fig. 2A. Then make a knife cut in one end of the four ⅞-in. wide pieces as in Fig. 2B. Insert tips of each pair of serrated tines into end slots as in Fig. 1 and push holder 3 in. into the new sponges as in Fig. 2B.

The 1½-in. wide portion of the sponge can be used to swab clean your prints before ferrotyping and drying them.—FRANK HEGEMEYER.

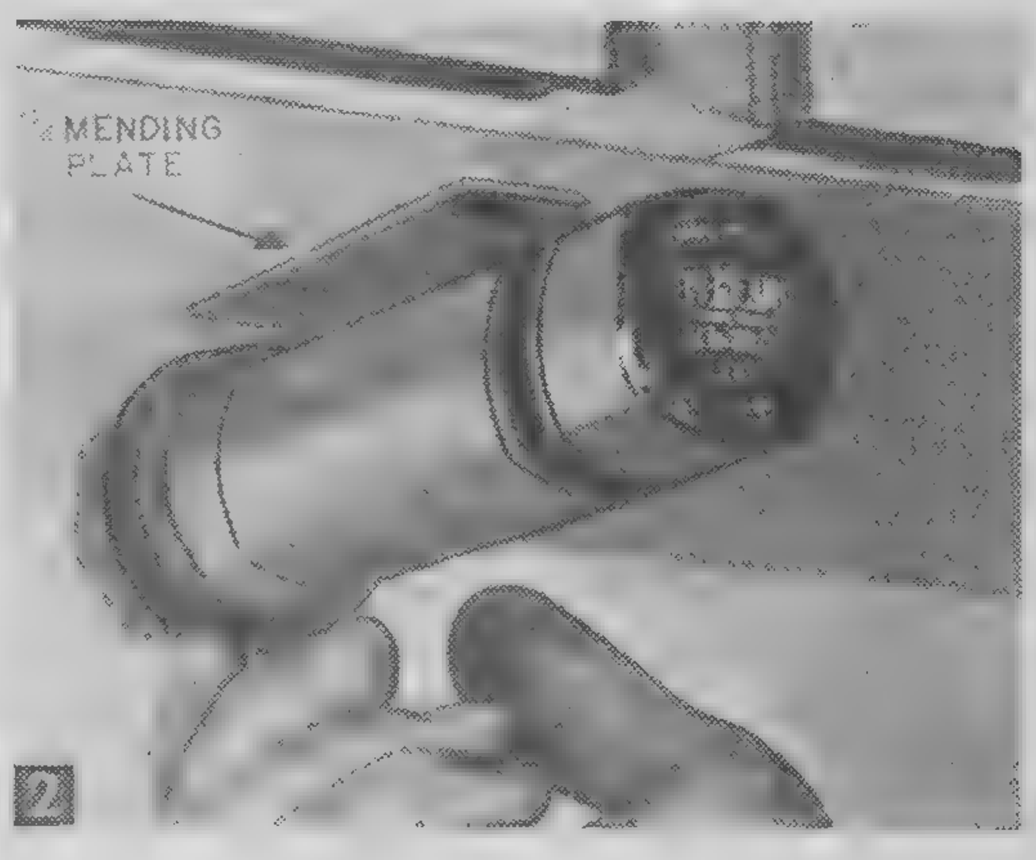


Tines of the squeegee holder work easily into place with help of end slit made by a sharp paring knife. Same knife cut sponge neatly.

Off-beat Uses for Mending Plates

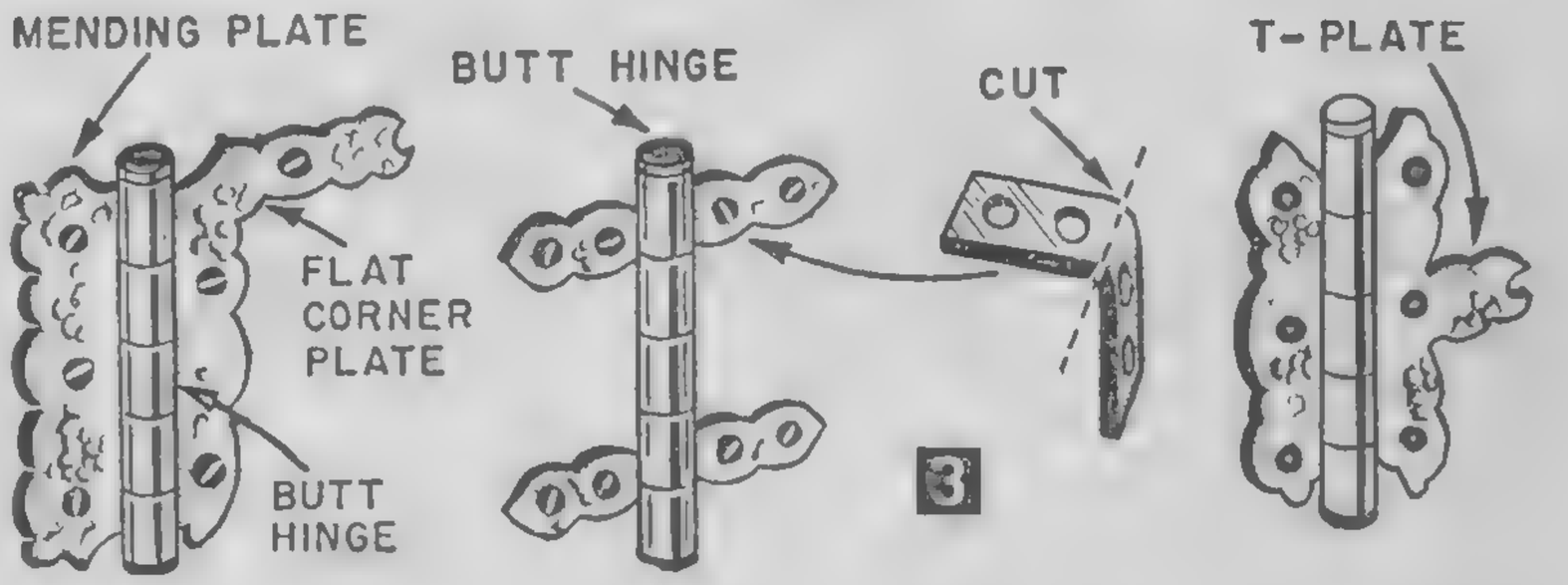


1



2

WHENEVER you have a shop problem calling for small, flat metal parts, consider those ordinary steel mending plates, corner braces and T plates (Fig. 1). They are readily available, easy to work with, and come already drilled and countersunk.



3

Alnico permanent magnets are being used more and more every day in the shop, kitchen, garage and at your desk. But if your furniture and cabinets are wood, how do you use the magnets? That's right. The small mending plates are there, ready to be attached with screws to wood surfaces, providing metal bases on which to hang magnetic flashlights (Fig. 2), potholders and other gadgets.

Paper notes, drawings and recipes are easily held up in sight between a mending plate and a small magnet. Also, with a mending plate and a magnet, you can put a magnetic latch on any cabinet door.

In addition, they can be quickly adapted to such uses as false fronts for common butt hinges, and they make inexpensive but realistic substitutes for antique Spanish and Early-American forged hardware (Fig. 3). A T plate can be made into a drawer pull (Fig. 4) by forming the leg over a large bolt, for a finger catch.

4

Antiquing Techniques. Texture the surface with a ball peen hammer and decorate the edges and unused screw holes with a file to give the effect of fret sawing and piercing.

Give these parts a dark finish to complete the antique effect. Add nitric acid to 4 ozs. of iron filings until the filings are completely dissolved. Then add 2 ozs. more of the nitric acid, 1 oz. copper sulfate (blue vitriol), 1 oz. sweet spirits of nitre and 3 ozs. of alcohol. Then add this mixture to 1½ pts. distilled water. *Wear a pair of rubber gloves* and coat the parts (don't forget the hinges and screws!), with the solution, using an old sponge. Then place the parts in the solution about 10 hours or until they are the desired color. Remove them, rinse with clear water, dry and coat with oil.—EDWIN M. LOVE.

Build Your Own

Portable Binocular Stand

Set up in a minute, stand takes over the tiresome hand job of holding instrument steady while user sights distant object and adjusts focus.

IN THIS satellite age, your high-power binocular can become a useful space prober with help of the portable stand in Fig. 1, which will tilt, rotate and hold fast in any position. Bird watchers, too, will find it a great aid to keep the narrow-field, powerful lenses glued to the target under study.

A clamp assembly customed to your binocular has front and rear semi-cradles which slide sideways for easy adjustment. A rubber ball mounted on a dowel arm serves as a handle to tilt and swing the assembly, which is locked in position by wing nuts. The unit can be raised or lowered to the nearest inch by a holed extension rail. Fold-up legs lock up or down. A web belt secures the stand for carrying by a convenient handle (Fig. 2).

You can assemble the project mainly from scrap pieces of wood and assorted bolts often found in the average home craftsman's junk box. Most of the wood is ¾-in. stock and all of these pieces will cut out of a 5-ft. length of 1 x 6 (¾ x 5⅝ in. actual size).

Part of the clamp assembly will vary depending on size of your binocular. Modify dimensions given in the Materials List as necessary, then cut all wood pieces. Note that the mount cleat should conform to width of platform on top and of tilt prongs on bottom. During assembly, secure all non-movable joints with glue and 4*d* or 6*d* finishing nails.

To make the clasp assembly in Fig. 3, cut semi-circular portions of cradles and anchor lock slightly larger than binocular contours to allow room for felt strips. Drill fixed

Small web belt with buckle, tacked to one of the legs just above handle, ties legs in compact folded position.

cradles, cradle rail block, and adjustable cradles for ¼-in. dia. rod as shown. Countersink two 3/16-in. dia. x 4-in. machine bolts through rear fixed cradle. Now mount assembly in place on platform after making sure adjustable cradles do not bind.

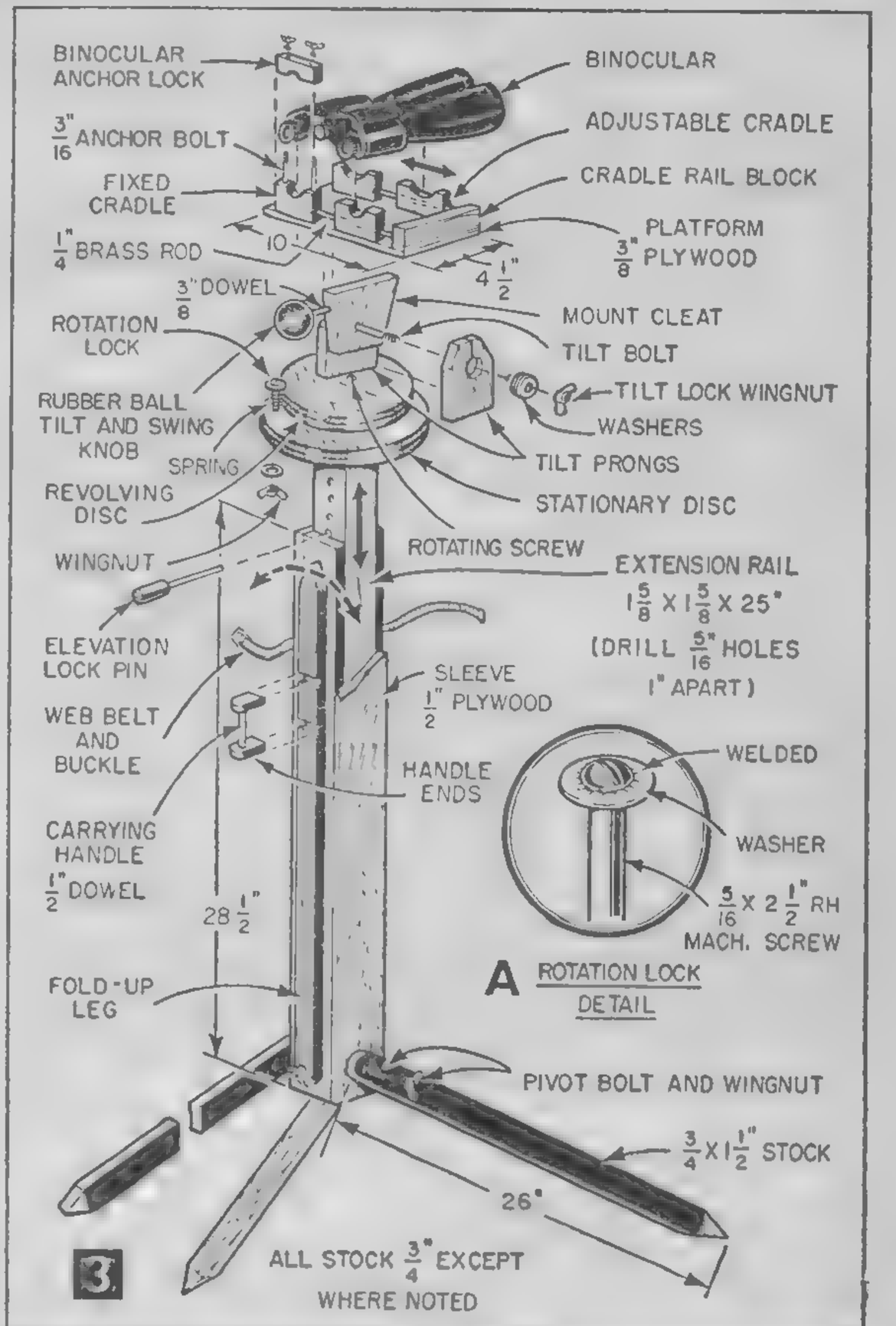
Clamp tilt prongs and mount cleat in position to drill a ¼-in. dia. hole through all three pieces for the tilt bolt as in Fig. 3. Drill ⅜-in. dia. hole in rear edge of mount cleat, then glue tilt and swing knob in place. Center mount cleat under the platform.

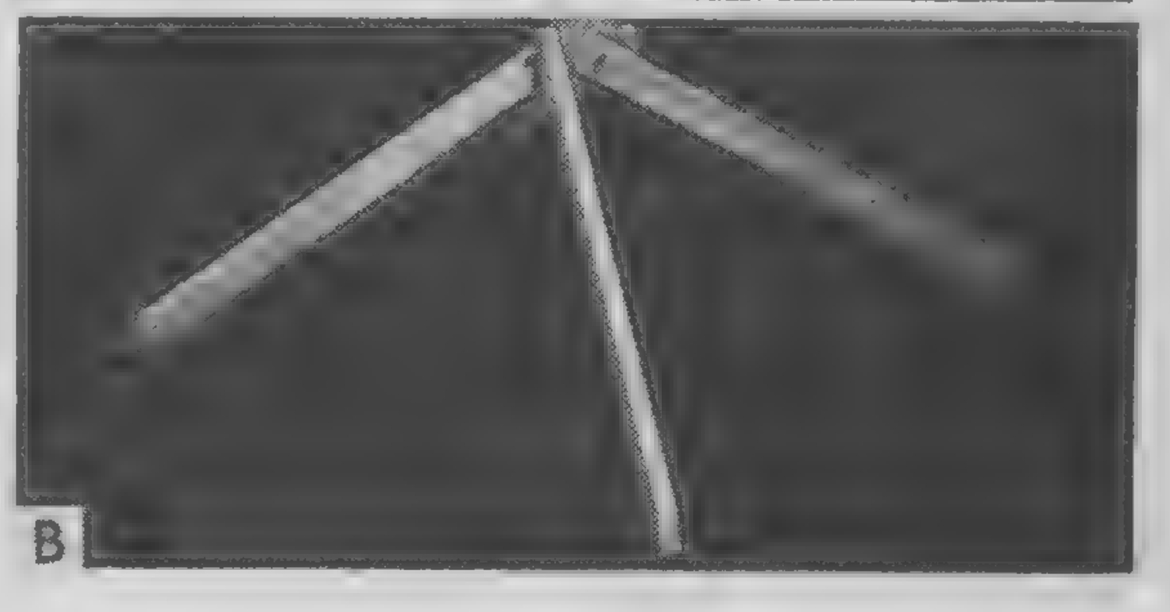
Carefully drill a series of 5/16-in. dia. holes 1 in. apart through the extension rail (Fig. 3). Center-mount the 6-in. dia. stationary disc on extension rail. Drill and countersink a pivot screw hole through center of 4-in. dia. revolving disc. Cut a washer hole through right tilt prong, mount tilt prongs on revolving disc, and center mount disc with a #8 x 1½-in. *fh* screw to larger disc so that it will rotate freely. Thread the 3-in. tilt bolt through the tilt prongs and the mount cleat as shown, then add enough washers so that a wing nut will lock them against the mount cleat to hold clamp assembly fast.

Make the rotation lock as in Fig. 3A and drill a receiving hole for it through stationary disc so that the lock will overlap the revolving disc. Fit an expansion spring over bolt to lift it clear when unlocking.

When nailing up the sides of plywood sleeve, allow at least 1/16-in. clearance for extension rail. Cut the legs, point the feet and attach as in Fig. 3B. Rabbet out about 4 in. from pointed end of one leg to receive the handle ends.

Sand stand thoroughly and apply a wood preservative and finish in stain or enamel. When dry, glue felt strips to contoured edges of cradles and anchor. —Merton H. Slutz.





MATERIALS LIST—BINOCULAR STAND

No. Req.	Size and Description
4 pcs.	¾ x 1¾ x 3″ pine (cradles)
1 pc.	¾ x 1 x 3″ pine (anchor)
1 pc.	¾ x 1 x 4½″ pine (cradle rail block)
1 pc.	¾ x 4 x 4½″ pine (mount cleat)
2 pcs.	¾ x 2¼ x 3″ pine (tilt prongs)
4 pcs.	¾ x 1½ x 26″ pine (fold-up legs)
2 pcs.	¾ x 1½ x 2½″ pine (handle ends)
1 pc.	¾ x ¾ x 2″″ pine (lock pin handle)
1 pc.	1⅝ x 1⅝ x 25″ pine (extension rail)
1 pc.	⅜ x 4½ x 10″ plywood (platform)
2 pcs.	½ x 2¾ x 28½″ plywood (sleeve sides)
2 pcs.	½ x 1¾ x 28½″ plywood (sleeve sides)
1 pc.	¾ x 6″ dia. plywood (stationary disc)
1 pc.	¾ x 4″ dia. plywood (revolving disc)
2	¼″ dia. x 6″ brass rods (cradle rails)
1	¼″ dia. x 4″ brass rod (lock pin)

No. Req.	Size and Description
1	5/16-18 x 2½″ *rh* machine screw, wing nut and washers (rotation lock)
1	¼-20 x 3″ mach. bolt, wing nut (tilt bolt)
2	3/16-24 x 4″ mach. bolts, wing nuts, washers (anchors)
4	3/16-24 x 1½″ mach. bolts, wing nuts, washers (leg pivots)
1	¾ x 24″ web belt buckle (leg ties)
Misc.	5/16″ dia. expansion spring, 1½″ dia. solid rubber ball, ⅜″ dia. x 3″ hardwood dowel, ½″ dia. x 5″ hardwood dowel, #8 x 1½″ *fh* wood screw for rotating disc, washers, 1/16 x ¾ x 16″ felt strip, 4*d* and 6*d* finishing nails, glue, stain or enamel.

It's "easier than sawing a board" say users of this precision metal shaper. With inexpensive tool bits you can do professional quality work, finishing castings, surfacing and trueing steel parts, key-seating, and other typical shaper operations.

Craftsman's Metal Shaper

Jewel-like precision, plus accurate hand control make this 3½"-stroke metalworking shaper ideal for home craftsmen, gunsmiths, experimenters.

By S. S. MINER

MADE almost entirely from stock-size cold-rolled steel, this precision craftsman's shaper can be built for $70 or less, and with it you can do work that would require a commercial shaper costing over $600.

Most of the work of building it is drilling and tapping, and bench work such as reaming, sawing, and filing. Some metal lathe work is required, but if you do not have a lathe, you can get the necessary machining done for $12.50.

A Complete Kit (including all steel cut to length, fastenings, and miscellaneous parts) is available for $69.61 (see Materials List for source of supply). If you are already pretty well stocked with cold-rolled steel in sizes useable in this machine, you can order the remaining sizes cut to length from any steel supply house. Most such firms will hacksaw this material to within 1/16 in. of the desired length, charging for the number of cuts and the total weight of steel bought. Do not have cold-rolled cut in a shear, as shearing deforms the ends of the pieces.

The fastenings and other parts can be had from hardware supply houses (see Materials List). However if you plan to buy most or all of the parts, it will probably be best to buy the kit.

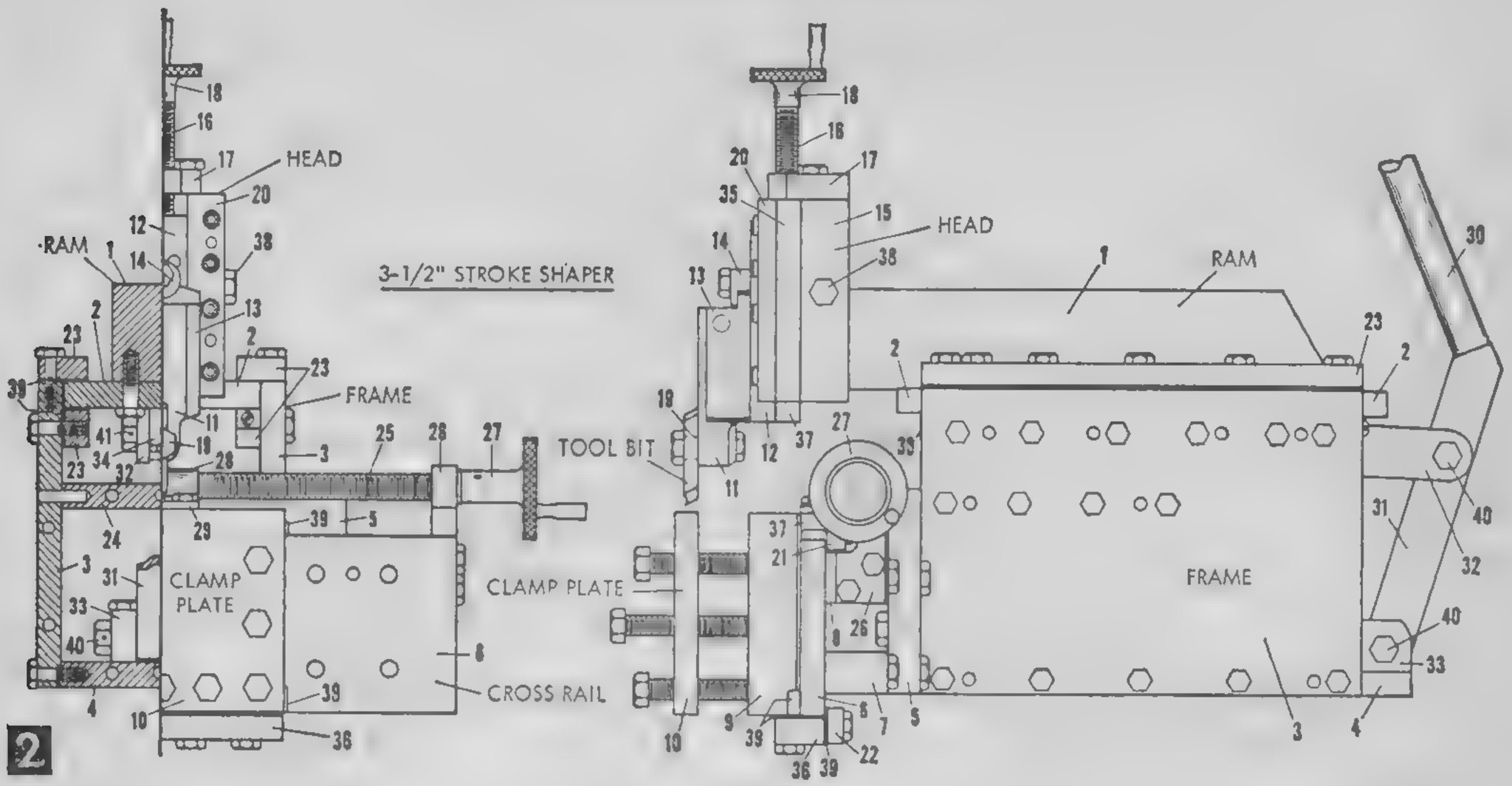
This design is the result of a careful study of the forces involved in cutting steel and other metals. It was found that only moderate effort is needed, working through the powerful hand lever, to remove very satisfying amounts of metal. Accurate, flat surfaces, the specialty of the shaper, are easily produced in the home shop with this tool.

A Particular Advantage to the home workshopper is the versatility of the work done on the shaper with inexpensive, easily sharpened cutter bits. Milling operations, whether done in a lathe or a milling machine, require costly cutters that can only be sharpened by specialists.

Commercial tolerances on cold-rolled (also called cold-finished) steel are plus .000 in., minus .003 in. on width and thickness, and in the short lengths used here variations will probably not exceed .001 in. These facts allow a very accurate assembly to be made, when, as in this shaper, the mill-finished surfaces are the ones placed together. The hand-finished ends, with few exceptions, are in the open and do not affect accuracy. Exceptions will be dealt with as they come up.

The sequence of making and assembling the parts has been worked out so as to progress from one clamped-up partial assembly to another, drilling for and inserting screws, and checking the accuracy of the work at each step. You will find it is like building with very accurate blocks.

Start Construction by fitting the ram to the ram head (Fig. 3). This lathe work, whether done outside or in your own shop, must pro-



1	ram	15	head	29	saddle driving lug
2	ram plate	16	downfeed screw	30	actuating lever (upper part)
3	side plate	17	downfeed screw bracket	31	actuating lever (lower part)
4	base plate	18	downfeed screw handwheel	32	driving link
5	apron	19	tool post	33	actuating lever pivot blocks
6	cross rail	20	tool slide gib	34	driving link block
7	cross rail spacer (lower)	21	saddle gib (upper)	35	tool slide gib spacer
8	cross rail spacer (upper)	22	saddle gib (lower)	36	lower saddle gib spacer
9	saddle	23	ram gibs	37	tool slide (rear part)
10	clamp plate	24	web	38	head clamp screw
11	tool holder	25	traverse screw	39	gib liners
12	tool slide (front part)	26	traverse screw bracket	40	actuating lever pivots
13	clapper box	27	traverse screw handwheel	41	driving link pivot
14	clapper box clamp	28	traverse screw nut		

duce what machinists call a "snug" fit, that is, there should be no play between the parts, moderate hand pressure being required to assemble them. Turn the neck on the ram first, then remove it from the lathe and chuck and bore the head. As the desired bore size is approached, the ram neck can be tried in the bore by pushing lightly on the ram with the tail center. This insures accurate alignment of the parts.

Then set the head aside and clean the surfaces of the ram and the ram plate with a mill file to remove the raised metal around any dents or "dings" that may have resulted due to rough handling in the warehouse or in shipment. The idea is to restore the flat surfaces that existed when the steel was milled without changing its dimensions in any measurable degree. Also, "break" the corners by filing an imperceptible chamfer on all corners to eliminate burrs. This work, incidentally, will have to be done to each of the cold-rolled parts before drilling or assembling.

With the ram parts cleaned up, finish up the ends of the ram plate. Length of this plate is not critical; it need only be square and true on the ends. Scribe a line around the ends, square with the sides, and file to this line with a 10 or 12-in. bastard cut flat file. Check your work with a try-square, sighting it against the light to detect the high spots. Chalk these and take care to file them only, as the line is approached. Be sure to remove any filing burrs at the edges that may interfere with the squaring operation. Finish the ends with a smooth cut file, and make a 1/64-in. chamfer on all corners. Then polish the surfaces with 4/0 or 5/0 emery, or steel wool. This filing and finishing process will have to be repeated a number of times in constructing the shaper, so use sharp files and keep them clean with a wire file brush.

Next, the straightness of the ram and ram plate must be determined. While cold finished steel is quite accurate dimensionally, noticeable curvature may appear in even rather short pieces. This will do no harm if it is detected and proper compensation is made. With an accurate straight edge and a set of micrometer leaves (or thin paper) check the ram and ram plates, chalking the high points. Then, if two straight surfaces cannot be paired up, pair up surfaces of opposite curvature if possible, so that the bending of one piece will offset the bending of the other when the two are fastened together. After marking pieces for correct assembly, bevel and finish the rear end of the ram. Lay out the holes in the ram plate as in Fig. 3 and clamp the ram and ram plate together using a

MATERIALS LIST—CRAFTMAN'S METAL SHAPER

Cold finished steel (C-1018) flats (All dimensions in inches)

No. Req.	Size and Description	Use
2	½ x 6 x 9	side plates
2	½ x 4 x 10	base plate and ram plate
1	½ x 4 x 5½	web
1	½ x 4 x 5	clamp plate
1	½ x 3½ x 12	crossrail
1	½ x 1½ x 4	tool slide, inner part
1	½ x 1½ x 1⅝	downfeed screw bracket
2	½ x 1 x 9	upper ram gibs
1	½ x 1 x 5	lower saddle gib spacer
*1	½ x 1 x 4	tool slide, outer part
1	½ x 1 x 3½	driving link block
2	½ x 1 x 3	actuating lever pivot blocks
2	½ x 1 x 2⅝	traverse screw brackets
2	½ x ¾ x 9	lower ram gibs
1	½ x ½ x 5	upper saddle gib spacer
2	½ x ½ x 4	tool slide gib spacers
1	⅝ x 4 x 7½	apron
2	⅝ x ¾ x 5	saddle gibs
2	⅝ x ¾ x 4	tool slide gibs
1	¾ x 1 x 3⅛	tool holder
1	¾ x 1¼ x 11	lower crossrail spacer
1	⅛ x 1½ x 2⅝	clapper box
1	1 x 1¼ x 11	upper crossrail spacer
1	1 x 2½ x 4	head block
1	1 x 4 x 5	saddle
1	2 x 2 x 11	ram

Cold finished steel (C-1018) rounds

*1	2" dia. x 6	handwheels
1	7/16" dia. x 3	downfeed screw
*1	5/16" dia. x 4	handwheel spinning handles
1	5/16" dia. x 1½	clapper box pivot
1	¾" dia. x 7/16	clapper box clamp
1	⅛" dia. x 1½	traverse screw handwheel pins
1	3/32" dia. x 1	downfeed screw pins
1	½" dia. x 13½	traverse screw

Hot-rolled steel flats

1	1 x 1 x 6¾	actuating lever, lower part
2	¼ x 1 x 9	driving link
1	7/16 x 1½ x 1	saddle driving lug

Miscellaneous screws and parts

*1	½-20 x 1¼	hex head bolt or screw—tool post
*1	⅜-24	hex nut—tool post
*3	⅜-16 x 3	hex head bolts with nuts—lever & link pivots
*1	⅜-24 x 2	soc. head cap screw—clapper box pivot
1	5/16-24 x 1½	hex head screw—clapper box clamp
1	7/16-14 x 2½	hex head screw—head clamp screw
*1	¼	malleable pipe coupling—traverse screw nut
*1	2" dia. (approx.)	plastic knob—actuating lever
2	¼ x ⅝	iron rivets—driving link
1	10" long, ¼" extra strong black iron pipe—upper section of actuating lever	
1	12" long, ⅜" extra strong black iron pipe	
1	½-13 x 1½" bolt—lower end, actuating lever	
1	⅜-16 or ⅜-24 x 1½" bolt—upper end, actuating lever	

Brass or bronze

1	.020 thick x 6 wide x 18 long	phosphor bronze for gib liners and shims
2	⅜ I.D. x ½ O.D. x ⅝ long	flanged bronze bushings for traverse screw
2	⅝ I.D. x ½ O.D. x 1 long	plain bronze bushings for lever pivots

Fastenings

52	¼-20 x 1 hex head cap screws	frame and gibs
5	¼-20 x 1¼ hex head cap screws	upper saddle gibs
5	¼-20 x ¾ hex head cap screws	lower saddle gibs
2	¼-20 x ½ hex head cap screws	saddle driving lug
8	5/16-18 x 1¼ hex head cap screws	apron, and link pivot block
6	5/16-18 x 1 hex head cap screws	ram plate
4	5/16-18 x 1¾ hex hed cap screws	crossrail
6	5/16-18 x 2½ hex head cap screws	crossrail
4	5/16-18 x 1½ long hex head cap screws	lever pivot blocks
6	⅜-16 x 2½ hex head cap screws	clamp plate
*8	¼-20 x 1¼ long socket head cap screws	tool slide gibs
2	¼-20 x ¾ long socket head cap screws	tool slide
1	5/16-18 x 1 long socket head cap screw	apron
4	10-32 x ¼ long round head screws	ram gib liners
6	¼" dia. x 1¼ long (.0002" oversize) dowel pins	tool slide gibs and upper saddle gibs
41	¼" dia. x 1 long (.0002' oversize) dowel pins	all other pinning
3	1" cotters	lever and link pivots

* Items for which substitutions could be made. See text. In addition, the bronze items could be brass, if desired.

MATERIAL SOURCES

Steel—Joseph T. Ryerson & Sons, Box 8000-A, Chicago 80, Ill., or any steel supply house.
Phosphor bronze—Steel Sales Corp., 3348 S. Pulaski Rd., Chicago 23, Ill.
Dowel pins, bushings, cap screws, etc.—any local hardware supply company.
Shaper kit (Prices F.O.B. Niles, Mich.)—

A. All steel required (CRS and HRS) cut to length	$44.90
B. Bronze gib lining and bushings, pins, and all fastenings	24.71
C. Lathe work on ram, head block, feed screws, tool post	12.50

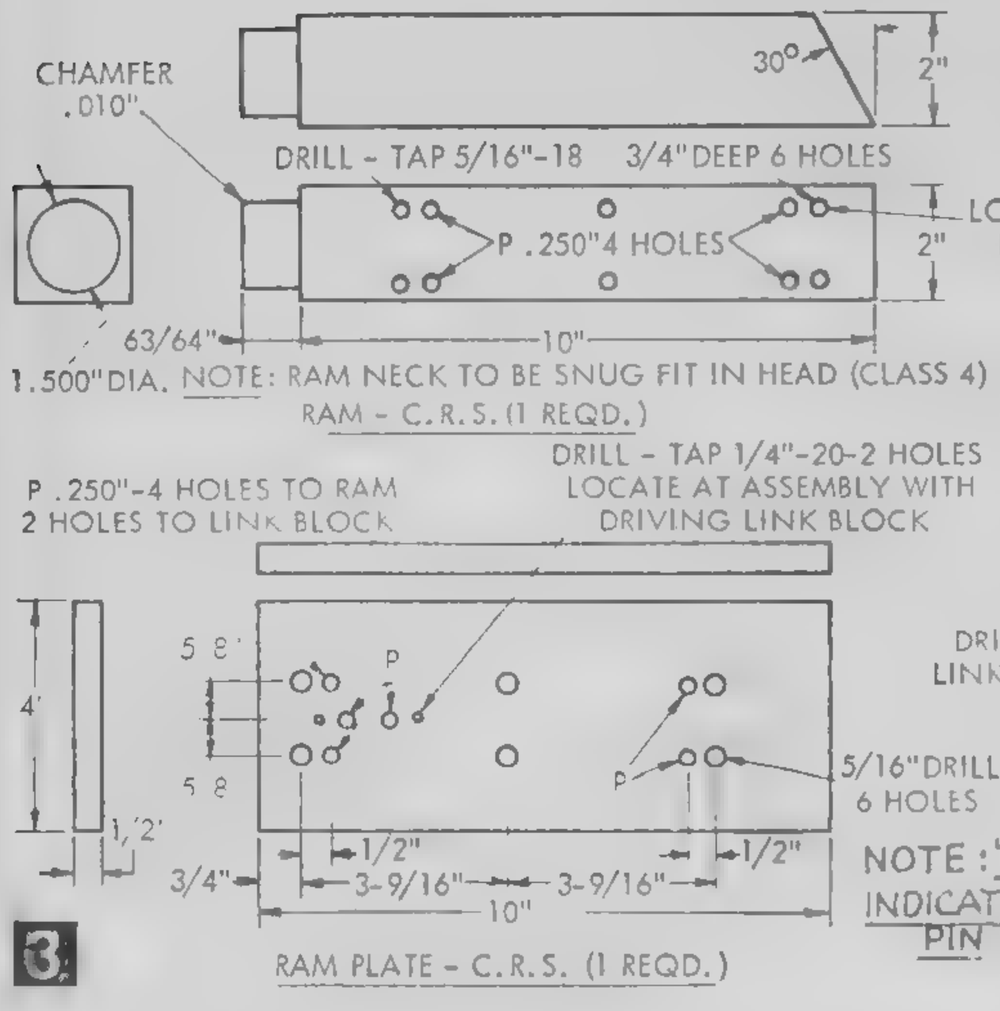
Kit available from S. S. Miner, Box 889, Route 4, Niles, Mich.

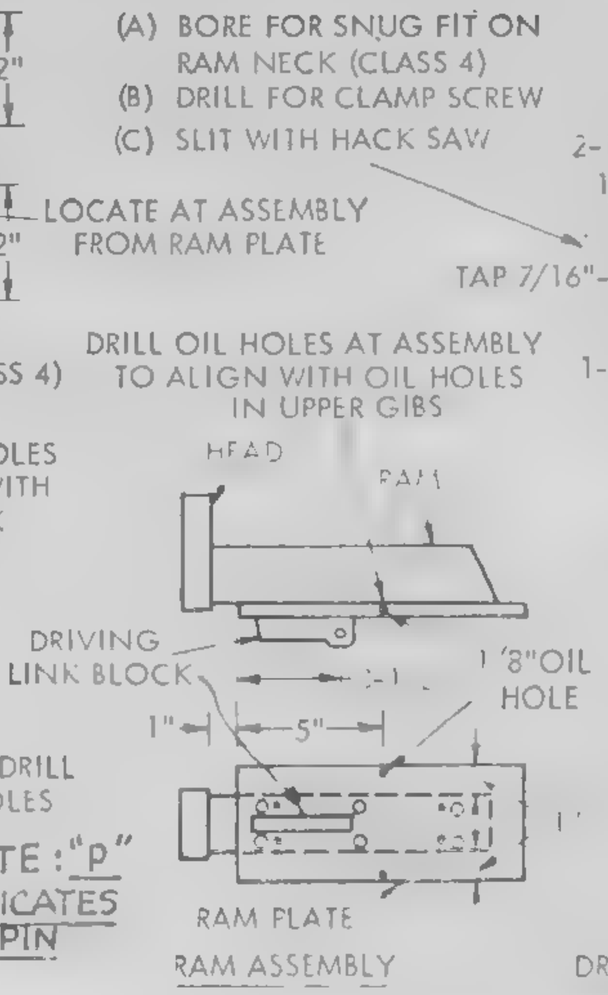
1-in piece of steel alongside the ram to center the ram on the ram plate as in the assembly drawing, Fig. 3. First drill the tapped holes with an F size drill to a depth of 1¼ in. Next, counterbore the holes through the ram plate only with a 5/16-in. drill. Then tap and insert the 5/16"-18 x 1-in. screws. Drill and ream the holes for the 1-in. dowel pins and fit in place without disturbing clamp-up.

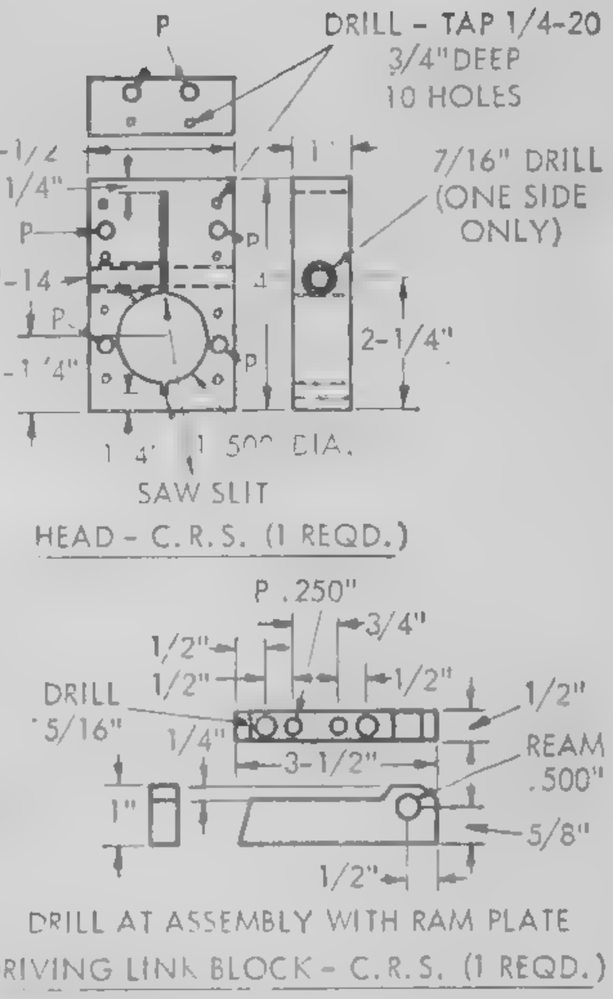
The pins used throughout the shaper, are hardened and ground dowel pins, .0002-in. over-size, making an accurate, tight assembly which can be disassembled.

Check the ram assembly with a straightedge, for both straightness and twist. Apply the straightedge diagonally to determine twist. The two edges of the ram plate must be parallel as well as straight, if the ram is to slide in a straight path without binding. Correct out-of-trueness by shimming between the ram and ram plate with shim brass, or with paper of various thicknesses, re-tightening the screws and rechecking each time different shimming is inserted.

Prepare the Side Plates (Fig. 4) next. First clean them up with a file and check them for flatness. If they are cupped, place the cupped surfaces together and clamp them with edges exactly aligned. Then mark the ends for filing. Length is not critical in these pieces, but note that the *front* ends abut the apron, hence extra care must be taken in filing these surfaces to get them square with the top edges, where the ram gibs attach. Dress the top edges too with a smooth-cut file and check for trueness. Finish the side pieces, and, before unclamping, mark them for assembly orientation with a prick-punch mark at the upper, inner, front corners. Then clean up and file the ram gibs (Fig. 4), matching their lengths to the side plates.

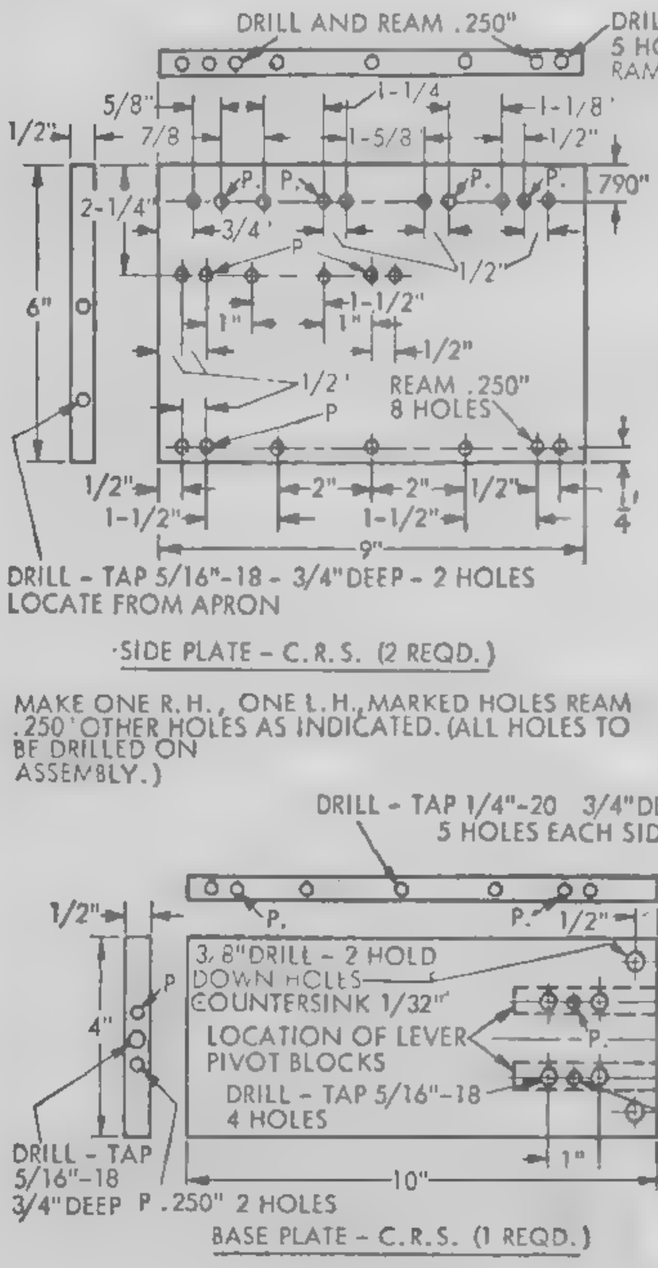


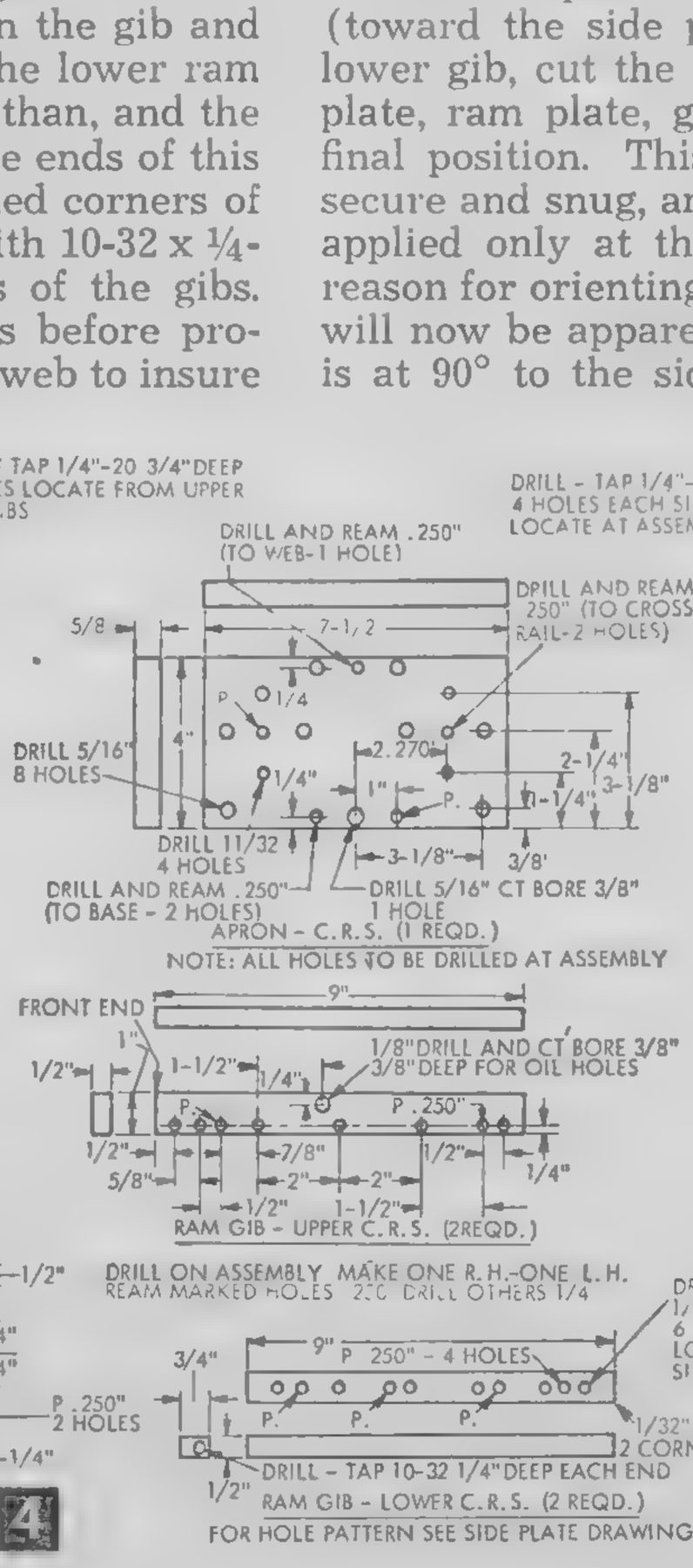


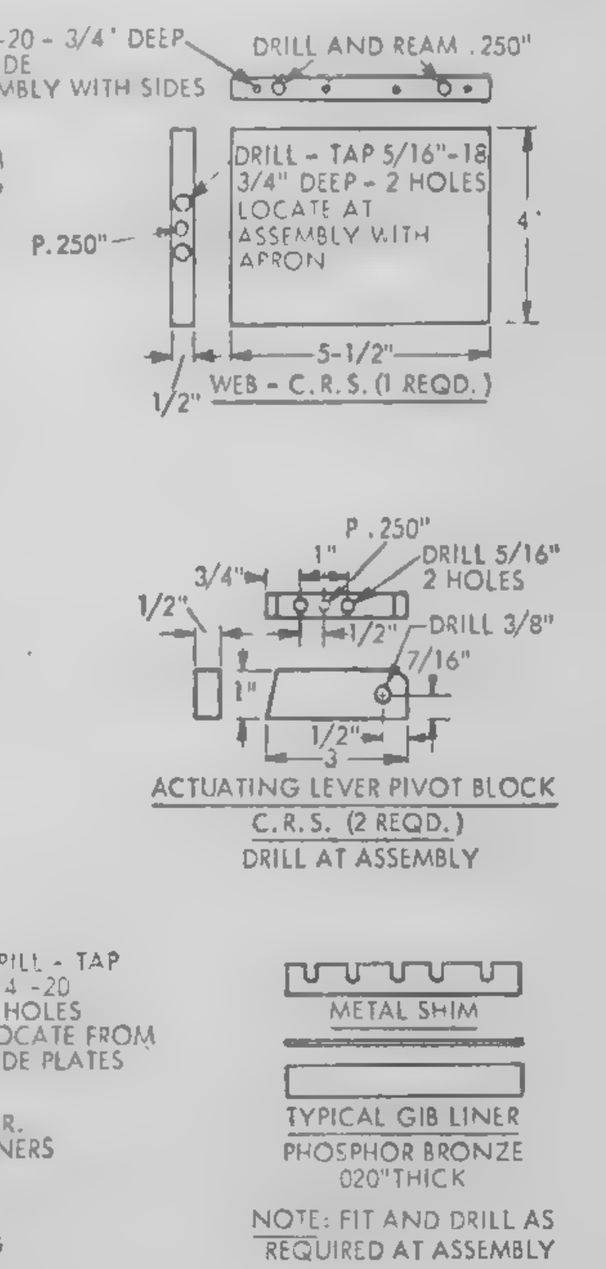


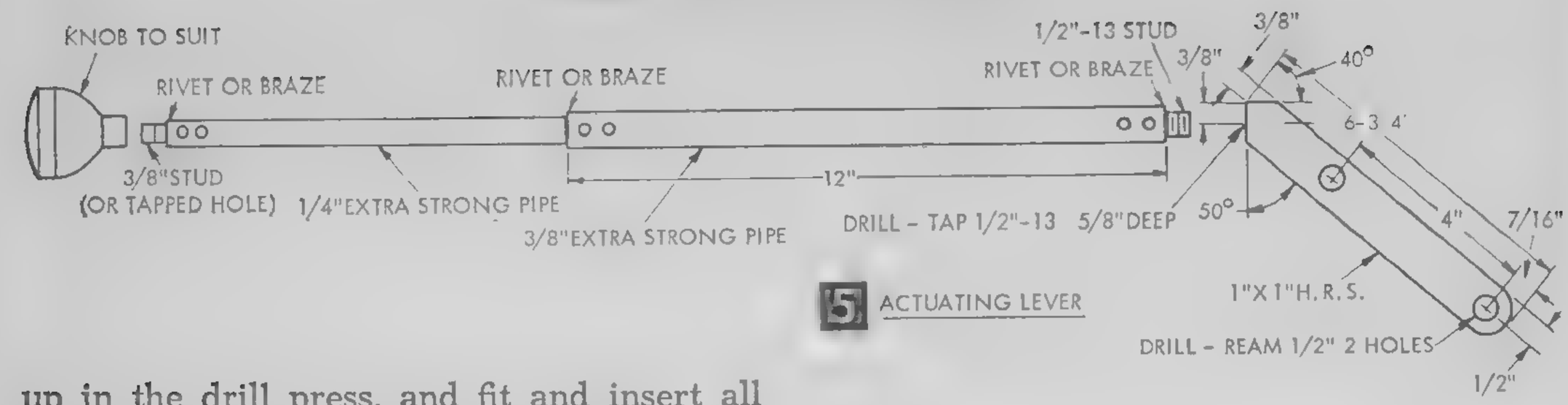
Installing the Gibs. Note in Fig. 2 that the ram gibs are lined with .020-in. phosphor bronze (detail #39 in Fig. 2). This lining must be cut to size from sheet stock with snips, and clamped up with each gib as drilling, inserting screws, and pinning are done. The top and side ram gib linings are held in place by being clamped between the gib and the side plates. When cutting the lower ram gib lining, make it ¾-in. longer than, and the same width as, the gib. Bend the ends of this lining down over slightly rounded corners of the gibs, and hold in position with 10-32 x ¼-in. *rh* screws let into the ends of the gibs. Complete both sets of ram gibs before proceeding with the base plate and web to insure correct alignment of the ram.

Start by installing an upper gib and its liner on one of the side plates. Clamp these parts up securely for drilling and pin and screw them together. Next, check a lower gib for straightness, and if curved, mark convex sides to be positioned upward and outward (toward the side plate). Fit the liner to a lower gib, cut the side liner, and clamp side plate, ram plate, gib, and liners together in final position. This clamp-up must be very secure and snug, and since the clamps can be applied only at the ends of the pieces, the reason for orienting the convexities of the gib will now be apparent. Be sure the ram plate is at 90° to the side plate. Block the work









5 ACTUATING LEVER

up in the drill press, and fit and insert all screws and pins through the side plate into the gib, working from the ends to the middle and tightening as you go.

The ram plate should be quite tight between the gibs—too tight to slide. This will be freed up later; for now, remove it and repeat the assembly with the opposite plate.

Assembling the Frame. Clean up the base plate (Fig. 4) with a file, taking particular care with the front end, which abuts the apron. Drill the two ⅜-in. hold-down holes at the rear of the base plate and make and install the actuating lever pivot blocks. When drilling for these, clamp them in position with the 1-in. square lever stock (Fig. 5), plus about .010 in. shim between them, to insure free action of the lever. Drill the pivot holes through the pivot blocks and the actuating lever (lower portion) at this same clamp-up, as it will be difficult to do later.

Then remove the pivot blocks from the base plate, and clamp it up with both side plates and the ram plate. Be sure to insert shims of the same thickness as the ram gib liners (.020 in. thick) between the side plates and the base plate to insure parallelism of the side plates. Strips ½-in. wide and of the same phosphor bronze can be used for this purpose. Drill and fasten both sides of the base plate at this assembly, checking to be sure the side plates stand perpendicular to the base plate. Then, finish up and install the web (Fig. 4), including .020 in. shims on either side.

Next, clean up the apron and finish its ends with a file. Clamp the apron to the frame and drill for fastenings. Note that the four screw holes into the side plate ends are 1/32-in. larger than the screws where they pass through the apron. This is to allow a slight sidewise shifting of the plates when they are adjusted by shimming at the base and web to obtain the proper fit of the ram slide. Note also, in measuring out from the center line for these holes that allowance must be made for the thickness of the web and base plate shimming, .020-in. in this case.

Of the seven screws that fasten the apron to the frame, six are 5/16-in.-18 x 1¼-in. long hex-head cap screws. The one in the center of the bottom is a 5/16-in.-18 x 1-in. socket-head cap screw. This screw is recessed into the apron, since it is behind the lower cross rail spacer. The other six screw heads are in the open.

Trueing Up the Frame. With the apron fastening complete, check the apron for flatness, and for 90° relation to the ram. Corrections, if required, can be made by shimming, or by slightly filing the frame ends.

At this same time, whatever shimming is necessary to true up the frame and free the ram should be added between the side plates and the web and base plates. These shims can be strips of paper or metal punched out to correspond to the screw and pin holes, or notched as in Fig. 4, to slide between the parts without removing the fastenings. Very little shimming should be required, unless the side plates are severely cupped. If the side plates and base are not in 90° relation when fastenings are tight, corrections of a few degrees can be made by inserting ⅛-in. wide shims between side and base plate, either above or below the line of fastenings, as required.

Adjust the side plate shimming with the upper ram gibs free so that the fit of the ram plate against the *side* gib liners can be determined; then with side plates and apron securely fastened, tighten the upper gibs. If this makes the ram too tight, add shimming between the upper gib liners and the top edges of the side plates. One thickness of thin paper (.002 to .003 in.) should be about right. This shimming and trueing operation should leave the ram fairly tight in its gibs; just about possible to move by hand. Use a little oil when checking this. The ram will free up in the first few hours of use.

Drill the oil holes through the upper gibs and liners into the ram plate as in Fig. 4. Then remove the ram and continue drilling the ⅛-in. holes through the ram plate. Drill a horizontal hole communicating with the ⅛-in. vertical oil hole in the edge of the ram plate, to carry oil to the side gib liners. Counterbore the oil holes in the upper gibs ⅜-in. x ⅜-in. deep to act as oil reservoirs. These will be stuffed with cotton in the finished machine, to keep out dust and to help hold the oil. Deburr all ⅛-in. holes before reassembling the slide.

Making and Installing the Crossrail. The crossrail must be true and straight, and at 90° to the ram slide, as this line-up will effect

Taking a cut across a 1¼-in. square steel bar. Inexpensive ¼ x ¼-in. lathe tool bits are used. Tool head tilts to right or left.

the accuracy of work done in the finished shaper. The apron (Fig. 2) must be removed from the frame during clamping and drilling, as the 5/16-in. 18 hex-head screws holding the crossrail assembly together enter from the rear surface of the apron.

Make the crossrails as in Fig. 7. File the ends of the upper crossrail spacer square, because the traverse screw brackets will be fastened to them. Drill 5/16-in. clearance holes through the apron and crossrail spacers and tap the holes in the crossrail. Pin the upper crossrail spacer to the apron with two 1-in. long dowels, and to the crossrail itself with two more pins. The lower crossrail spacer is not pinned, as the screws holding the apron to the frame must be installed before the lower crossrail spacer joins the assembly. Additional screws (socket-head cap screws, recessed) can be installed through the crossrail into the lower crossrail spacer, if needed to true up the crossrail.

Before assembling these parts for the last time, make and install the traverse screw brackets (Fig. 7). Press 3/8 I.D. x ½-in. long flanged bronze bushings into the ½-in. reamed holes.

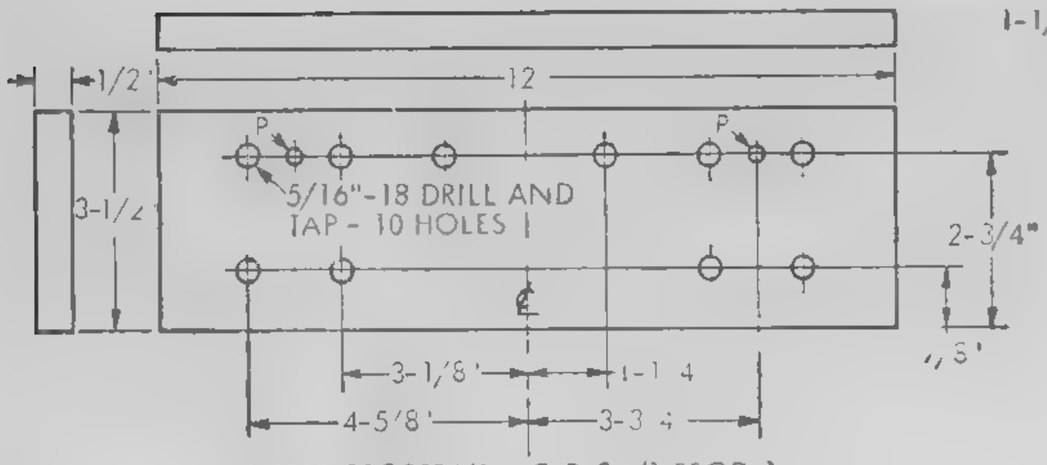
The Saddle and Clamp Plate Assembly is the vise which holds the work piece to the crossrail. First clean up the parts with a file as in Fig. 8. The saddle gibs are bronze lined as were the ram gibs. Note in Fig. 2 on p. 109 that the top saddle gib liner is retained in position merely by bending up its ends around the slightly rounded corners of the upper saddle gib spacer. Note also that the lower front liner is similarly held by being bent around filed notches in the lower inner corners of the saddle. The lower saddle gib spacer requires two thicknesses of the .020-in. shimming material between it and the saddle to compensate for the combined thicknesses of the upper and lower saddle gib liners. Note, too, that the hole layout in the lower gib parts avoids interference between the various screw and pin holes.

Fit of the saddle gibs on the crossrail need not be as tight as the ram slide, since gravity and the cutting forces of the tool bit will always keep the slack, if any, on the same side of the gibs. With all saddle gib screws tightened, it should be possible to slide the saddle freely along the crossrail by hand.

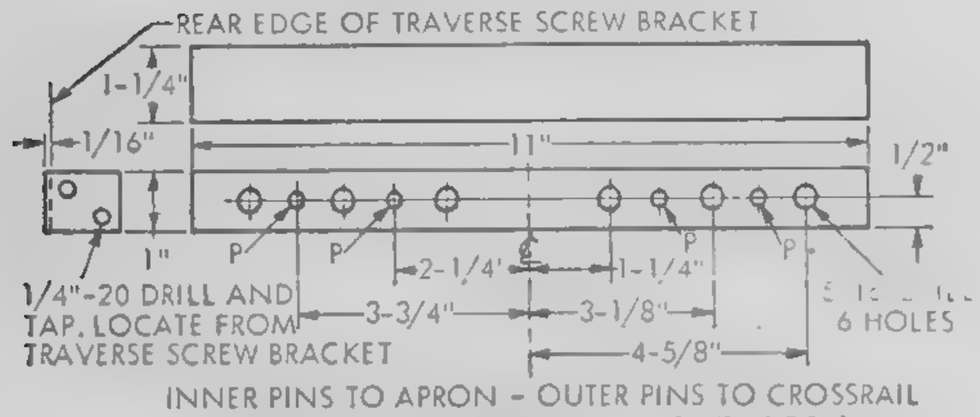
Make the Clamp Plate as in Fig. 8. The hole pattern corresponds to the hole pattern in the face of the saddle. The five corresponding holes are clearance holes for the 3/8-in.-16 holes in the saddle. The four additional holes in the clamp plate are tapped 3/8-in.-16.

Make the traverse screw as in Fig. 7 from a ½-in. steel shaft. When assembled, the threaded length should fit with a slight amount (.005 to .015-in.) of end play between the bushings in the traverse screw brackets. Make the nut by running a ½-in.-20 tap through a ¼-in. malleable pipe coupling. Although the pipe threads are not quite the same thread as ½-in.-20, the middle portion of the coupling is unthreaded and the tap will bridge the gap and make the pipe coupling usable.

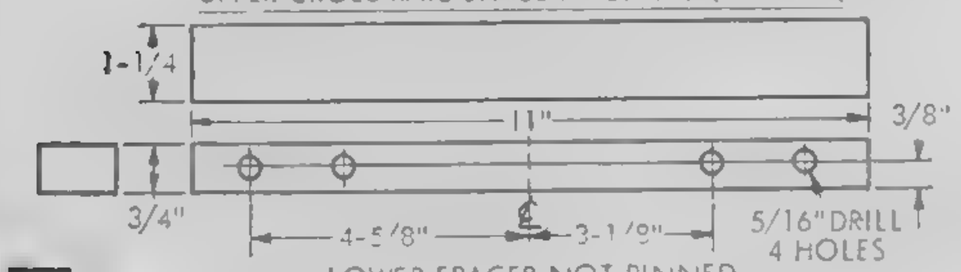
The nut may also be made from a piece of 3/8-in. extra strong pipe, drilled out and tapped ½-in.-20. File two notches in the nut as in Fig. 7 to fit loosely over the two projections on the saddle driving lug. Assemble all these parts, and drive the saddle back and forth



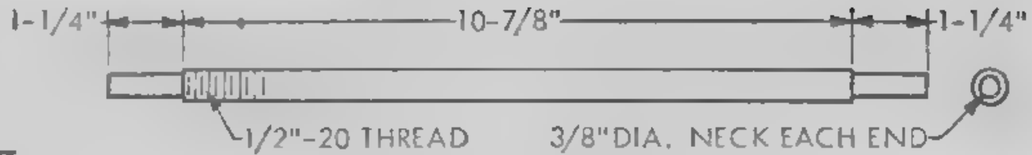
UPPER CROSSRAIL - C.R.S. (1 REQD.)



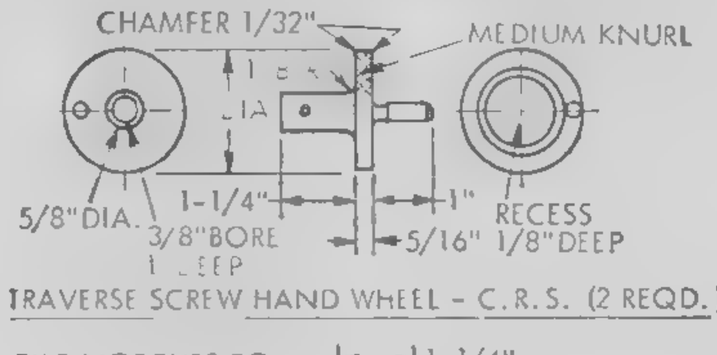
INNER PINS TO APRON - OUTER PINS TO CROSSRAIL
UPPER CROSS RAIL SPACER - C.R.S. (1 REQD.)



LOWER SPACER NOT PINNED
LOWER CROSS RAIL SPACER - C.R.S. (1 REQD.)



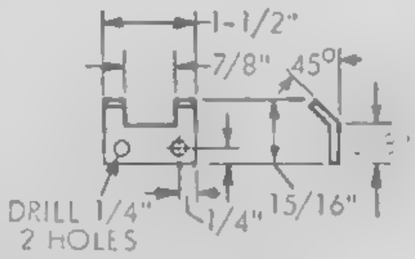
TRAVERSE SCREW - C.R.S. (1 REQD.)



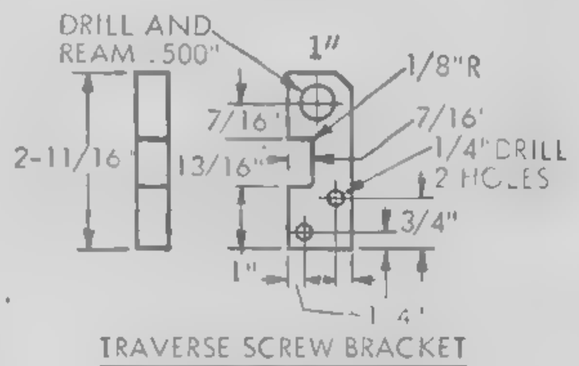
TRAVERSE SCREW HAND WHEEL - C.R.S. (2 REQD.)

FIT TO LUG
TRAVERSE SCREW NUT (1 REQD.)
3/8" EXTRA STRONG PIPE OR 1/4" MALLEABLE PIPE COUPLING

P - INDICATES PIN HOLE DRILL AND REAM .250"



FIT ON ASSEMBLY SADDLE DRIVING LUG
3/16" H.R.S. (1REQD.)



TRAVERSE SCREW BRACKET
C.R.S. (2 REQD.)

with the traverse screw, to be sure there is no binding.

The handwheels can be made of steel as in Fig. 7, or may be purchased die-cast handwheels. In either case, they slip on the ⅜-in. necks of the traverse screw and are held in place with ⅛-in. pins of drill rod. When installing the pins, swage them slightly on one end to hold them in position when driven in flush. If pins must ever be removed, drive them out from the opposite end. A few thousandths end play is desirable between the handwheel hubs and the flanges of the bushings. Pin the handwheels to the transverse screw with the spinning handles 180° apart; this will make two-handed operation of the transverse screw easier. Make sure, when pinning the handwheels, that the end thrust of the traverse screw is taken by the handwheel hubs against the flanges of the bushings, and not by the end of the threaded part of the screw against the inner ends of the bushings.

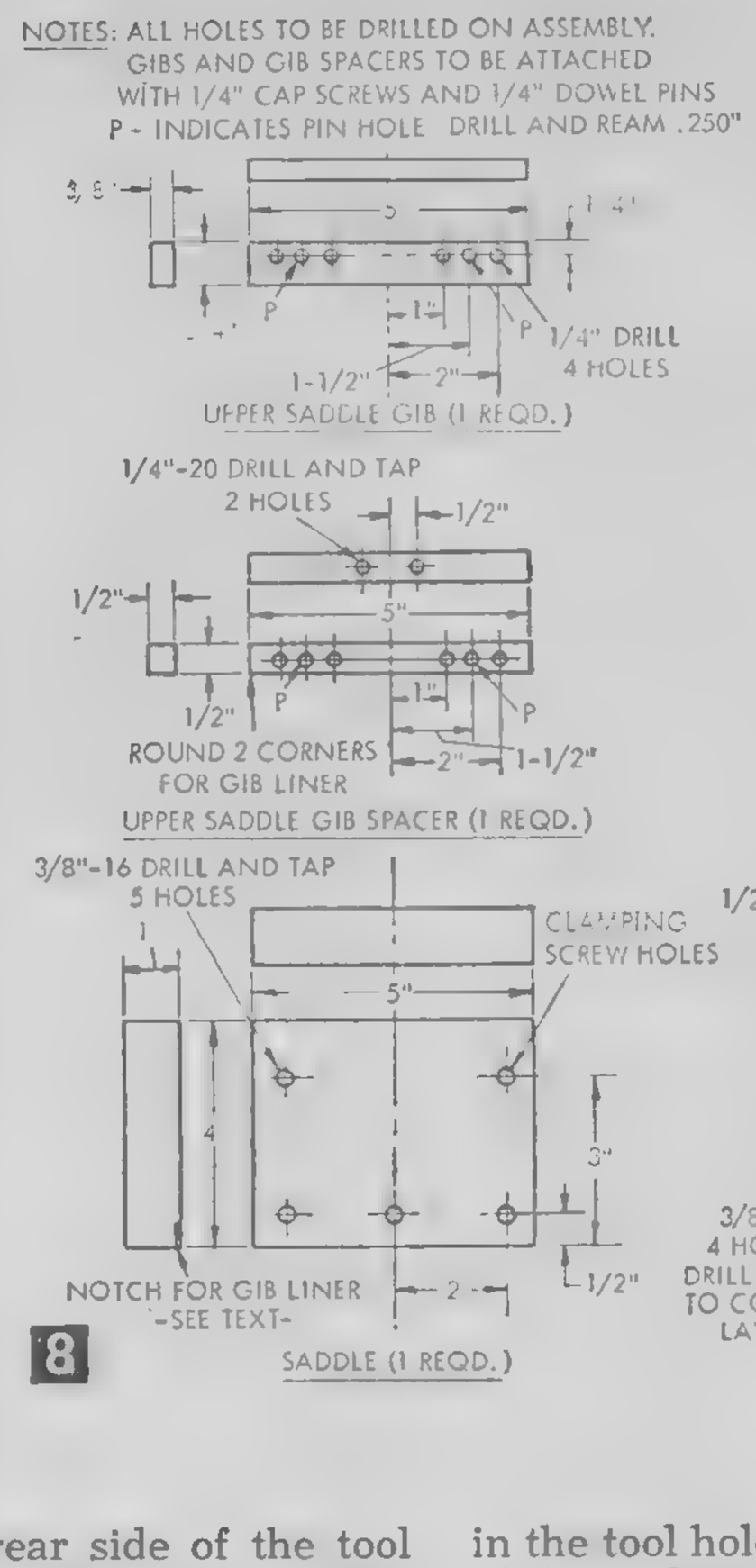
The Head. Drill the head (Fig. 3, p. 111) for the clamping screw and clean up and square this part. Note that downfeed screw bracket will later be assembled to the top end of the head. Slit the block with a hacksaw to within ¼ in. of each end. When the head is slit, strains existing in the steel since the time of manufacture may be relieved, causing the bore to enlarge or contract slightly. If it enlarges, the clamping screw will overcome it, but if it contracts, polish out the bore with fine emery (4/0 or 5/0) held on a small sanding drum, or in an extreme case, saw the hacksaw slit in the head block a little closer to the ends. In the completed shaper, it should be possible to swivel the head by hand, or by light raps with a lead hammer. Grease the neck when testing this.

Assemble the head on the ram neck and tighten the 7/16-in.-14 hex-head clamping screw. Next, clamp up the two parts of the tool slide (Fig. 9) and the tool-slide gibs and spacers on the head block. Be sure to clamp them securely and parallel to the sides of the head. The drilling, tapping, and pinning operations on the head gibs are all done with the head tight on the ram neck, so that the slide when completed will work with the head tight. If it frees up slightly when the head clamp screw is loosened, it will not matter, as re-tightening the screw will restore the fit of the slide. Fasten the tool slide gibs with ¼-20 x 1¼-in. long, socket-head cap screws with the screw heads recessed just enough to clear the clapper box as it pivots.

After the gibs are fastened with screws and four 1¼-in. long dowels, knock the two tool slide parts out far enough to drill them for, and install, two pins and one ¼-20 x ¾-in. socket-head cap screw with head recessed. Then knock the slide through the head the other way and drill for, and install, the remaining two pins and screw. Be sure half of the tool slide remains engaged in the gibs during each part of this operation. When the slide is fastened, disassemble it and drill and tap the clapper box pivot screw hole in the tool-slide front piece and the downfeed screw access hole in the rear piece. Drill the latter

hole ½-in., and file it flat and square at the top as in Fig. 9. Then reassemble the slide and fit it to the gibs. Drive it back and forth in the gibs, loosening them a little at first if necessary, to note the high spots. Use a minimum of lubrication so the tight spots will show as rubbed areas. File these off with a fine mill file, and try the slide repeatedly until a snug fit is achieved. This slide is not lined, as the amount of travel in the lifetime of the shaper will be negligible.

The clapper box (Fig. 9) can be made by drilling and hacksawing out most of the material and finishing by filing or grinding. If you have access to a lathe with milling attachment, it will make the job easier. The ⅝ x 1-in. groove must make a free fit with tool holder.



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Drill a recess in the rear side of the tool holder as in Fig. 9 to clear the head of the clapper-box pivot screw, which can be a ⅜-in.-24 socket-head or a fillister-head machine screw. When threading this screw, run the die up the shank of the screw only far enough so that the threaded part of the screw will jam in the threaded hole in the front part of the tool slide, like a pipe thread. This will permit a slack-free fit between the clapper box and tool slide without requiring retaining means for clapper-box pivot screw.

Make the clapper box clamp (Fig. 9) from a short length of ¾-in. shafting and drill an off-center hole in it to take a 5/16-in.-24 machine screw. Crown the outer face of the clamp to concentrate the clamping effect of the screw in the center of the clamp, and bevel its rear face so that the lip of the clamp will bear firmly against the flange of the clapper box. The clamping screw passes through a 5/16-in. clearance hole in the front part of the tool slide and enters a tapped hole in the rear part so the strain of clamping is carried directly to the gibs.

Make the tool post (Fig. 9), from a ½-in. hex-head bolt. Drill a ¼-in. hole through the bolt just under the head and file it square for a ¼ x ¼-in. tool bit. Turn the other end of the bolt down to ⅜-in. to fit the counterbore in the tool holder. Then thread the small end of the tool post ⅜-in.-24 for a hex nut which clamps the tool bit tightly in position by drawing it against the front side of the tool holder.

To eliminate the lathe work, the tool post may be left ½-in. dia. throughout its length, and a ½-in. hole drilled all the way through the tool holder.

Next, make the downfeed screw bracket as in Fig. 9 and clamp it to the head for drilling (Fig. 2, p. 109). After fastening this bracket drill a 5/16-in. hole through the bracket and into the tool slide access hole. Then remove the tool slide from the head, and finish drilling and tapping the 7/16-in.-20 hole in the downfeed screw bracket. This procedure insures proper alignment of the downfeed screw with the slide.

Make the downfeed screw as in Fig. 9, turning one end down to 5/16-in. and the other end to ⅜-in. Then cut the 7/16-in.-20 threads. Assemble the 5/16-in. end of the downfeed screw in the tool slide with a 5/16 I.D. x 3/16-in. long steel retaining collar as in Fig. 9A. Pin the collar in position with a 3/32-in. steel pin, swaged on one end.

After turning the downfeed-screw handwheel as in Fig. 9, fasten it to the screw with a 3/32-in. pin, swaged on one end. Use a 5/16 x

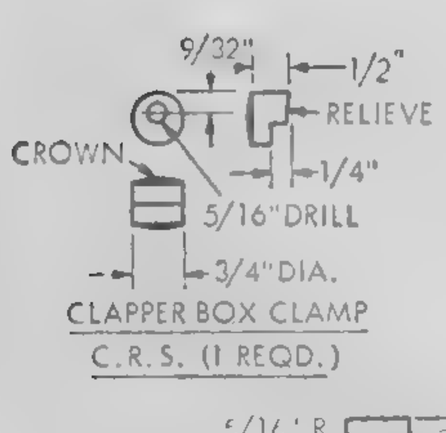
1½-in. long steel pin to assemble the tool holder to the clapper box so that the tool holder swings easily on the pin.

The Actuating Lever. Make the lower section of the lever from 1-in. square hot-rolled steel as in Fig. 5, p. 112. Hacksaw the upper end of this part at a 50° angle and tap a ½-in.-13 hole square with the 50° surface to take the threaded end of the upper section of the lever. Make the upper section from a 10-in. length of ¼-in. extra-strong pipe and a 12-in. length of ⅜-in. extra strong pipe, and rivet or weld them together to make a total length of 20 in. For the threaded portions at each end of the pipes, cut the heads off bolts and rivet or weld them in place in the ends of the pipe. The knob used on the end of the lever was taken from a Skil sander.

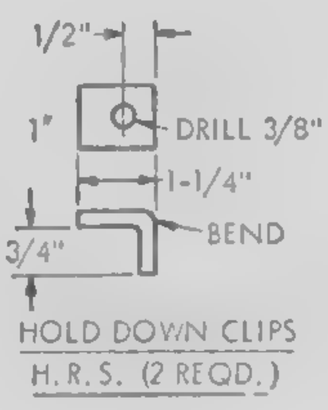
Press ⅜ I.D. x 1-in. long bronze bushings into the ½-in. reamed holes in the lower section of the lever. For pivot pins use ⅜-in. drill rod, cottered, or ⅜-in. machine screws with the nuts cottered on.

Make the driving link of two pieces bent and riveted together as in Fig. 9. Notch the front end of the link with a file to clear the ram-plate screws. Use a ⅜-in. rod or a bolt for the driving-link front pivot. This pivot is not bushed, since rotational movement at this point is very slight.

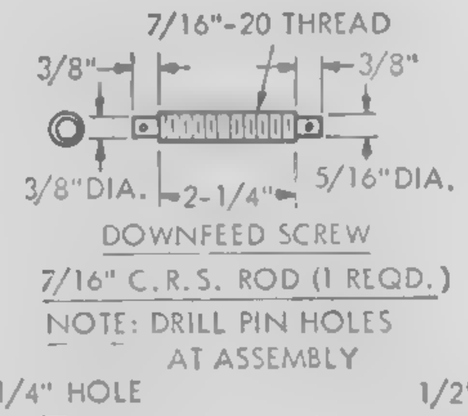
This completes the assembly of your shaper. File 1/16-in. chamfers on all corners and edges which might contact your hands, and clean up all exposed surfaces with steel wool. Two hold-down clips made as in Fig. 9 and fastened to your bench top with ⅜-in. bolts or lag screws will secure the front end of the shaper. These fit over the lower crossrail spacer. Fasten the rear end of the shaper to the bench top with ⅜-in. bolts through the hold-down holes in the base plate. Now you're ready to put this little gem to work.



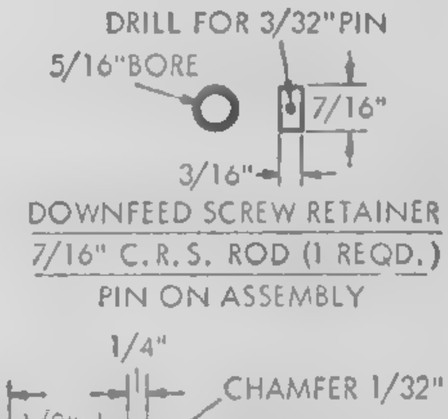
CLAPPER BOX CLAMP
C.R.S. (1 REQD.)



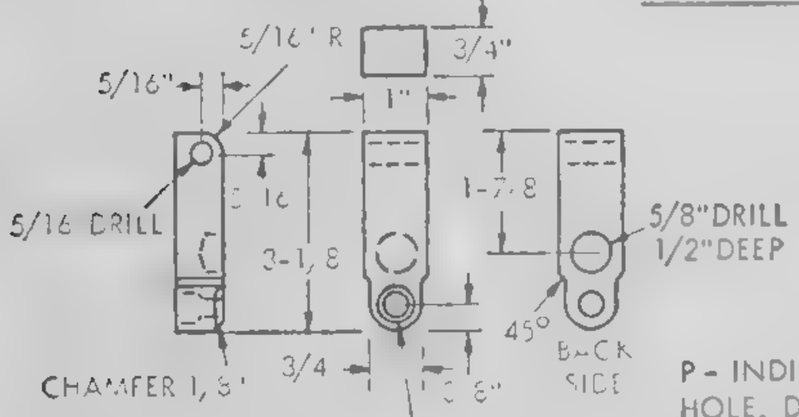
HOLD DOWN CLIPS
H.R.S. (2 REQD.)



DOWNFEED SCREW
7/16" C.R.S. ROD (1 REQD.)
NOTE: DRILL PIN HOLES AT ASSEMBLY

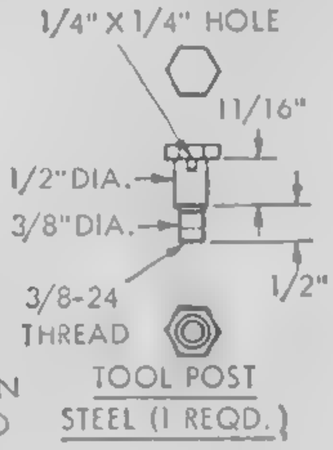


DOWNFEED SCREW RETAINER
7/16" C.R.S. ROD (1 REQD.)
PIN ON ASSEMBLY

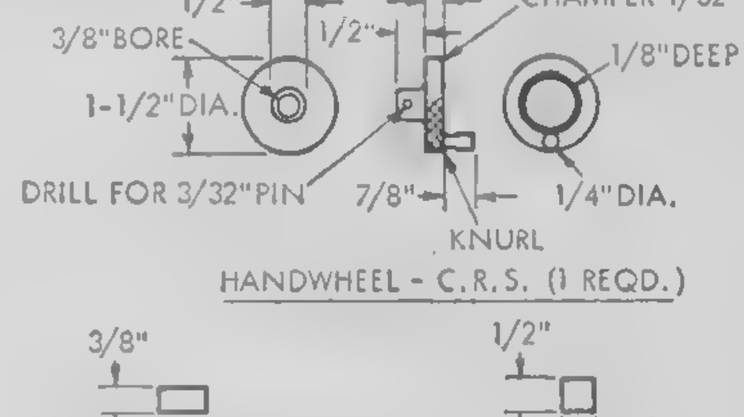


3/8" DRILL AND C'BORE 1/2", 1/2" DEEP
TOOL HOLDER - C.R.S. (1 REQD.)

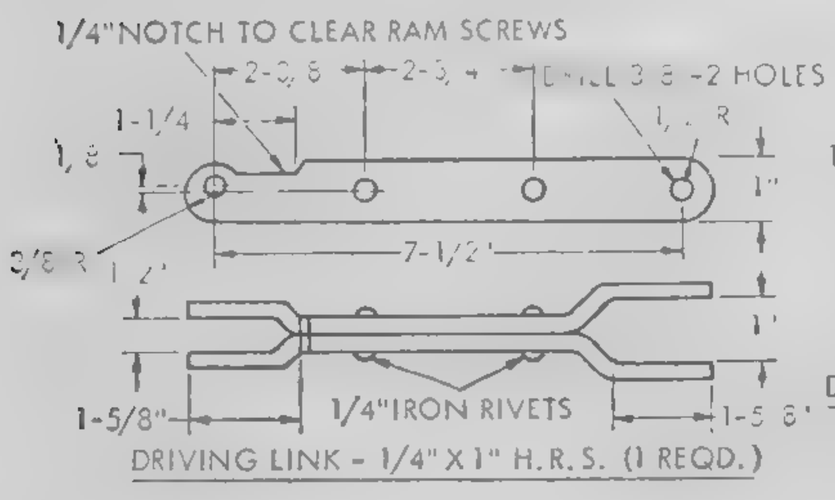
P - INDICATES PIN HOLE. DRILL AND REAM .250"



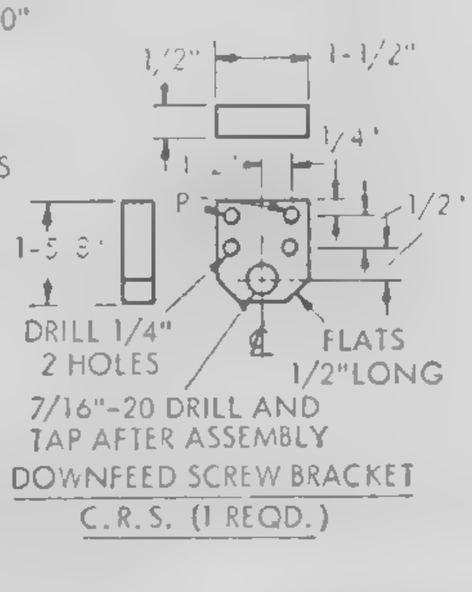
TOOL POST
STEEL (1 REQD.)



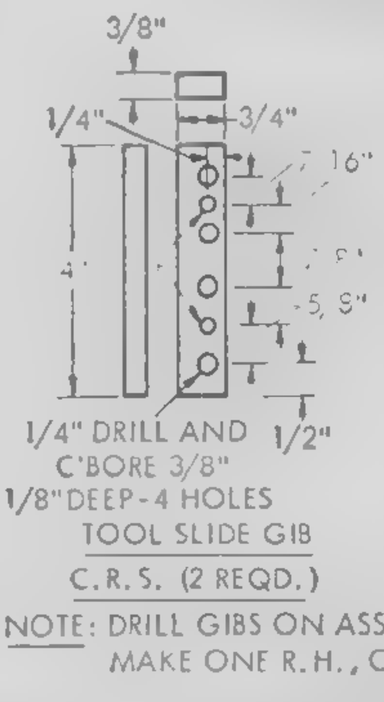
HANDWHEEL - C.R.S. (1 REQD.)



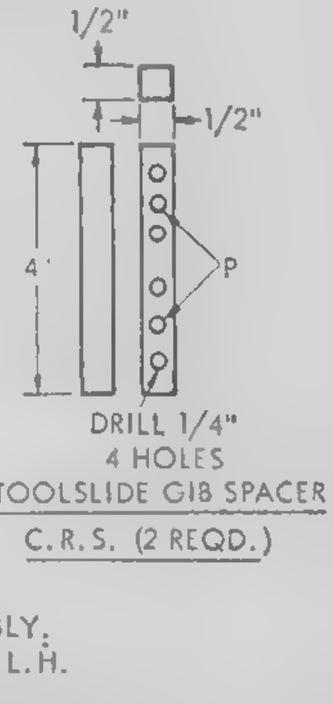
DRIVING LINK - 1/4" X 1" H.R.S. (1 REQD.)



7/16"-20 DRILL AND TAP AFTER ASSEMBLY
DOWNFEED SCREW BRACKET
C.R.S. (1 REQD.)

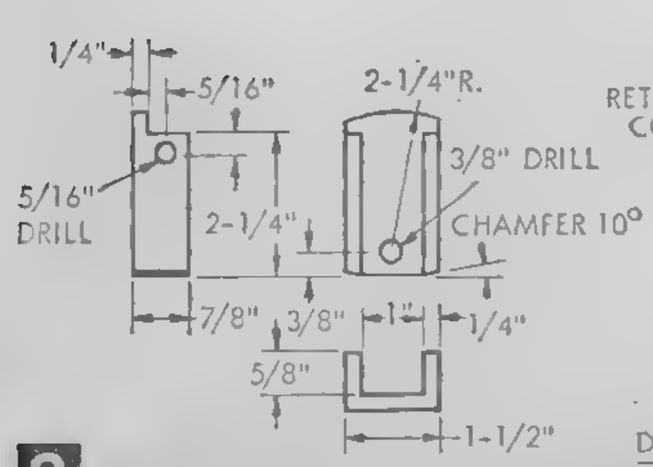


TOOL SLIDE GIB
C.R.S. (2 REQD.)

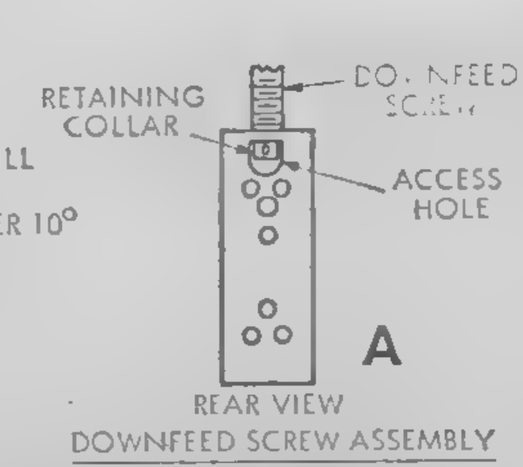


TOOLSLIDE GIB SPACER
C.R.S. (2 REQD.)

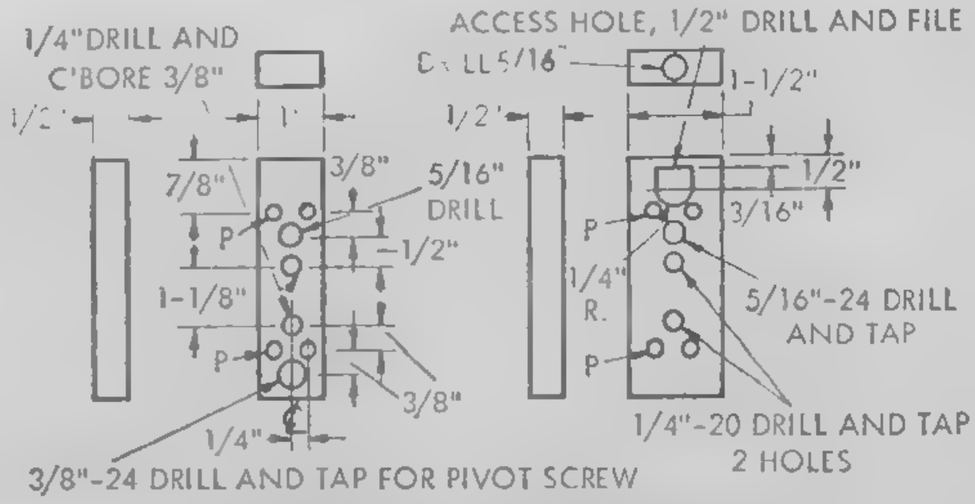
NOTE: DRILL GIBS ON ASSEMBLY. MAKE ONE R.H., ONE L.H.



CLAPPER BOX - C.R.S. (1 REQD.)



DOWNFEED SCREW ASSEMBLY WITH REAR PART OF TOOL SLIDE



TOOLSLIDE - C.R.S. (1 REQD. OF EACH)

Four-Jaw Chuck for Wood Lathe

A dollar and a dime (or less) is your cost to make this 4½-in. chuck

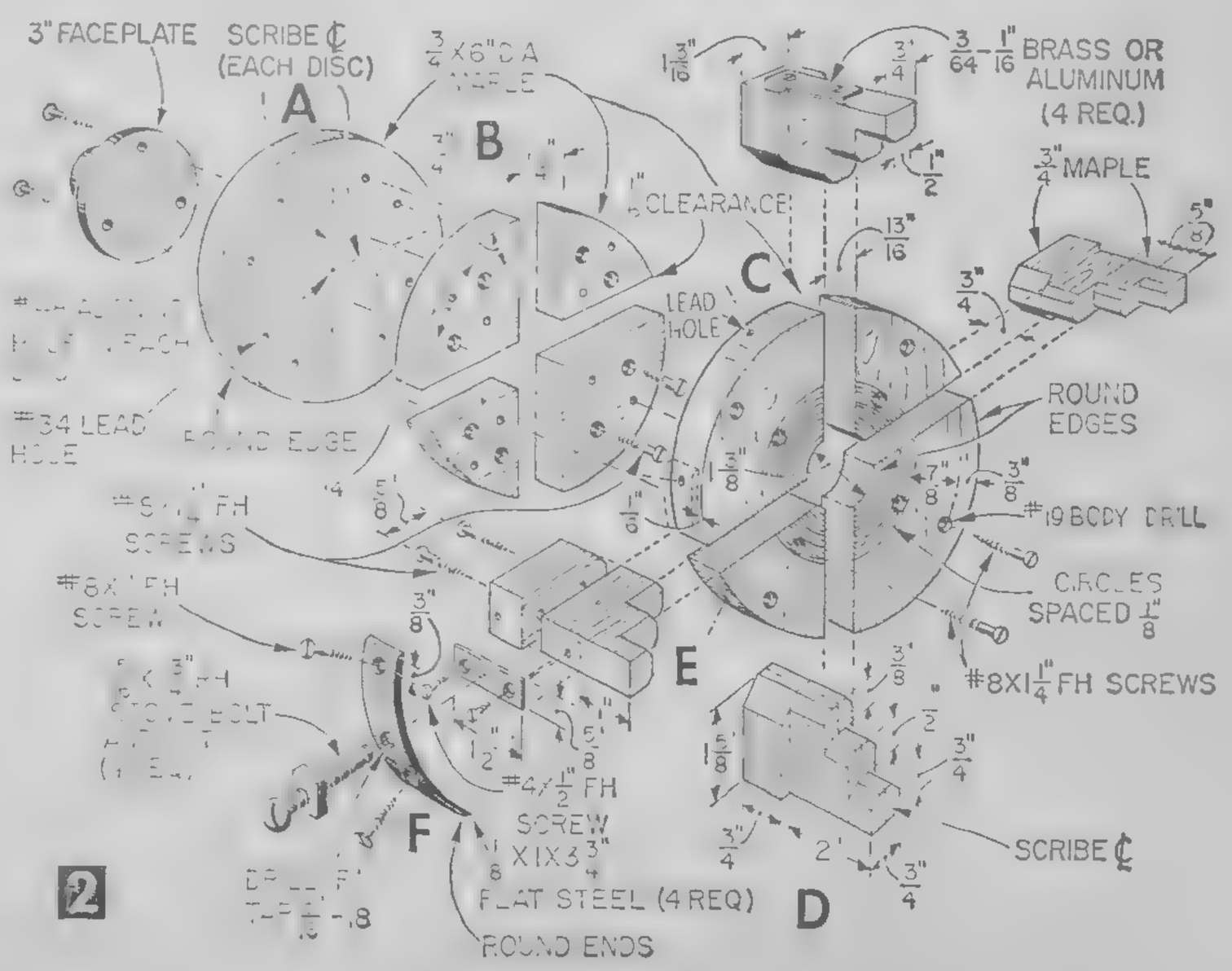
INCREASE the usefulness of your wood lathe with a hard-maple, 4-jaw independent chuck made of materials that are very likely in your scrap bin now, waiting to be used.

Lay out the three 6-in. dia. discs on ¾-in. maple stock, scribing in the centerlines, jaw positions and screw-hole centers (Fig. 2A, B and C). Rough out the discs on your band saw or scroll saw and drill a #48 hole in center of each disc as an aligning hole for the disc assembly. Also drill the #19 body holes for the screws, countersinking them to seat 3/64 in. below flush. Now run the #48 drill through the center of discs A and B and align the centerlines on their edges. Clamp them in this position and locate the lead holes in disc A. Drill the lead holes with a #34 drill and attach disc B to disc A with #8 x 1¼-in. *fh* screws. Repeat the procedure with disc C and attach it to discs A and B.

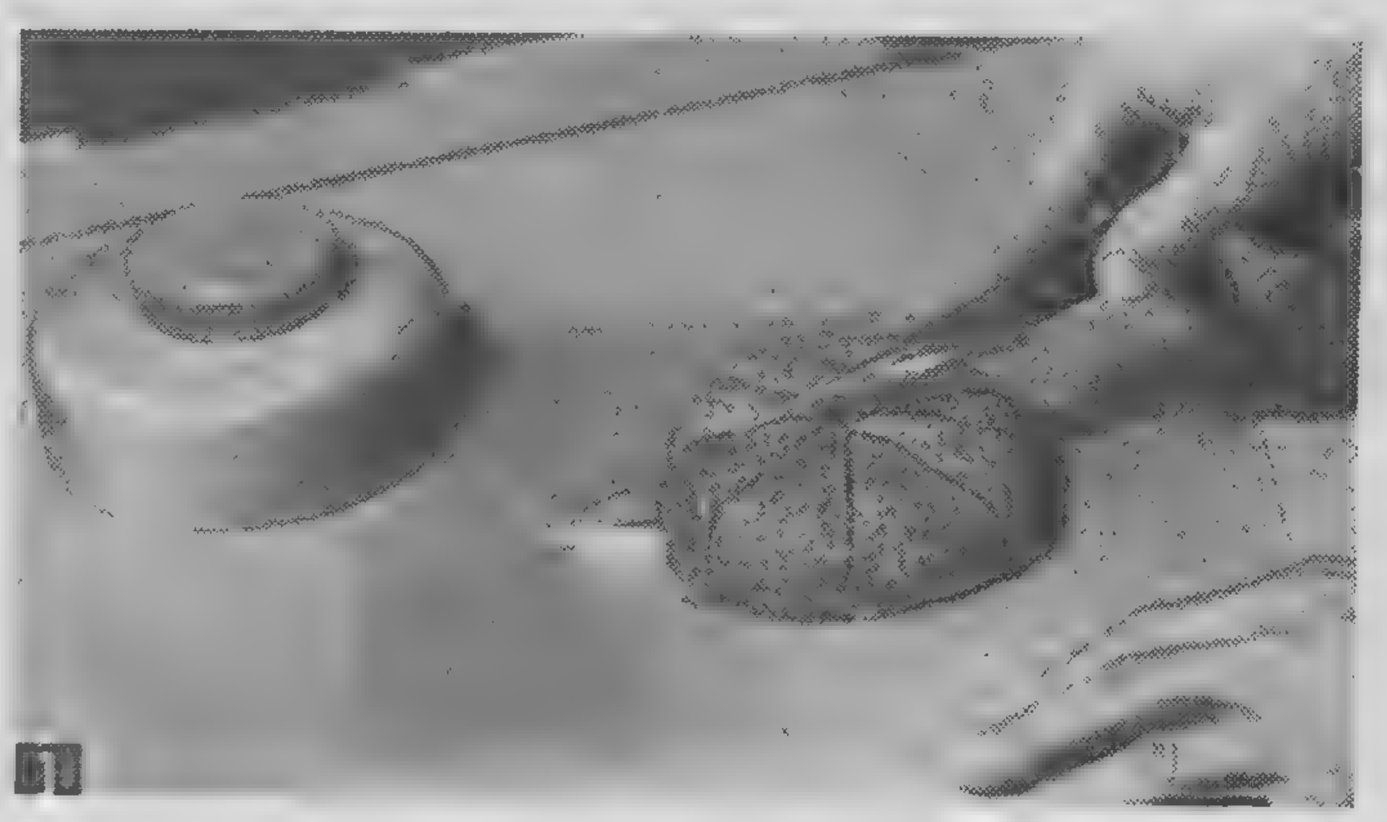
Now, carefully center and attach your 3-in. faceplate and mount the assembly on your lathe to true up the discs and sand them smooth. Also bore a 1⅜-in. hole through disc C and, with a spear-point chisel, cut light circles ⅛-in. apart to aid you in roughly centering stock in the chuck. Be careful not to cut as deep as the screw heads.

Now, remove chuck from lathe and, with a pencil, mark the edges of the discs on each side of the centerlines, using matching numbers or marks to align the parts when reassembling. Disassemble the discs to carefully saw out the segments for jaws (Figs. 2B and C) and then refasten the segments to disc A. Now saw out four two-part jaws from ¾-in. maple stock and assemble them with two #8 x 1¼-in. *fh* screws countersunk slightly deeper than flush. Then, with a chisel and disc sander, bevel the jaw edges as in Fig. 2D. Fit each jaw to slide freely in the chuck slot and mark the jaws to correspond with the chuck markings.

Cut Four Bearing Plates from 3/64 or 1/16-in. brass or aluminum and attach one to the back of each jaw with two #4 x ½-in. *fh* screws (Fig. 2E). Next, from ⅛ x 1-in. flat steel, cut the four screw plates (Fig. 2F). Drill holes for two #8 x 1-in. *fh* screws and drill and tap it for a #18 x 5/16-in. *rh* stove bolt. Bend each of these plates to fit the curvature of the chuck by placing it in a vise and bending it in successive stages while moving it up in the vise about ⅛-in. at a time. Locate and drill the #34 lead holes on the chuck edges and, after inserting jaws, attach the screw plates with #8 x 1-in. *fh* screws.—CARL W. BERTSCH.



Hamburger Divider and Press



Everybody gets an equal portion. Holding divider up, insert wax paper liner, fill with meat, and cover with another wax sheet. A pound will press exactly level with rim. Turn divider over on cutting board, then lift divider and top paper. Neatly scored meat is ready for the knife to complete the division.

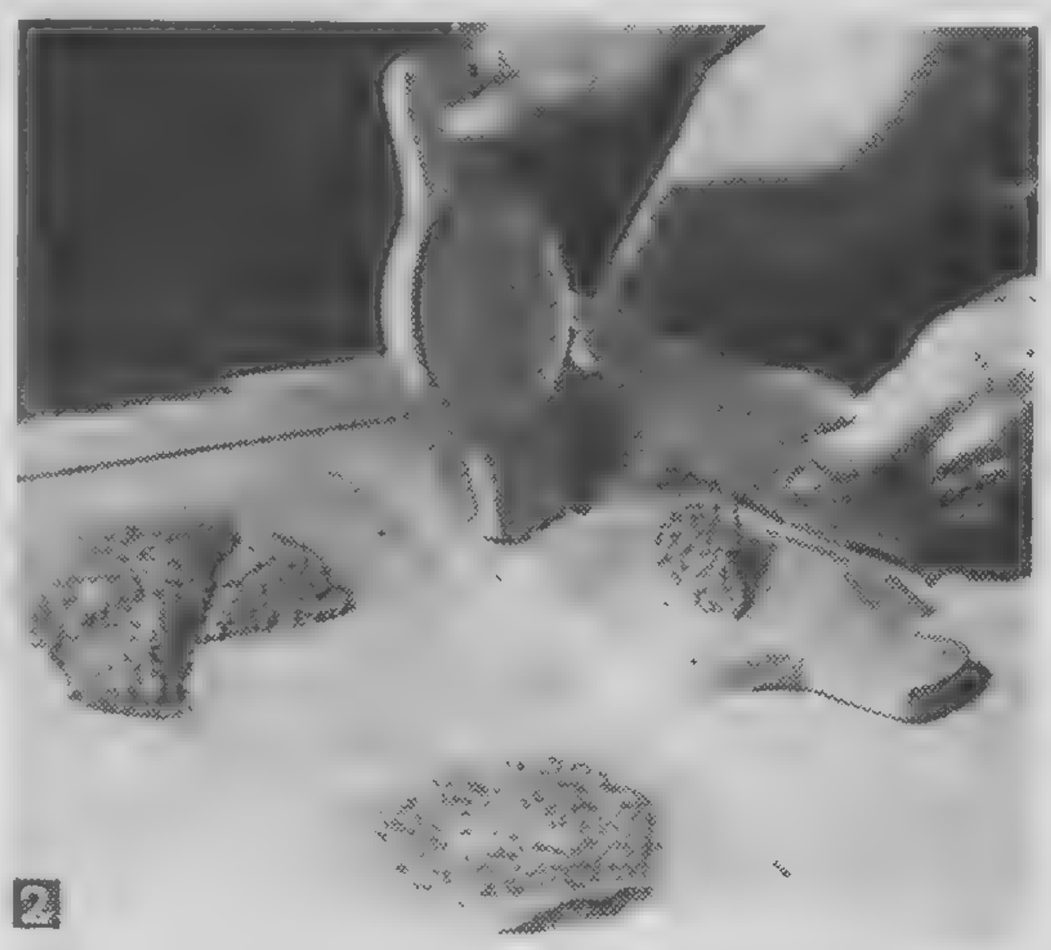
YOU'LL save time, avoid greasy hands and give everyone an equal portion with this two-piece hamburger preparation set, consisting of a divider (Fig. 1), which will score a pound of meat so you can quickly cut it into equal portions, and a patty press (Fig. 2).

The parts are designed for 3½-in. dia. buns at the rate of eight 'burgers to the pound. If inclined to be more generous, you can change that ratio to 6-1 or 4-1 merely by increasing the depth of the press top recess by 1/16 or 3/16 in., respectively, and decreasing the number of scoring lugs in the meat divider (Fig. 5E).

To prepare the top of the patty-press (Fig. 3A), glue and dowel a ¾ x 2⅝ x 10¼-in. pine board to each side of the ¾ x 5 x 10¼-in. maple stock, forming a 10¼-in. square. From center point of the square and on its poorest side, scribe three circles with radii of 2¼, 2⅜ and 5⅛ in. Round off corners by bandsawing along the 5⅛-in. radius circle. Center mount a 3-in. face plate on opposite side, using ½-in. #10 *fh* screws, and attach to lathe.

Form the press recess by dressing down the circular piece 3/16 in., except for that part between the 2¼ and 2⅜-in. radius circles (see Fig. 4). Use a roundnose chisel when shaping against either side of the ⅛-in.-thick rim remaining between the circles. Sand smooth with 2/0 and 6/0 paper, then remove from lathe, take off face plate and bandsaw to final shape as in Fig. 3A. Cut ⅞-in. piece off square end. Sand top and all edges to smooth finish.

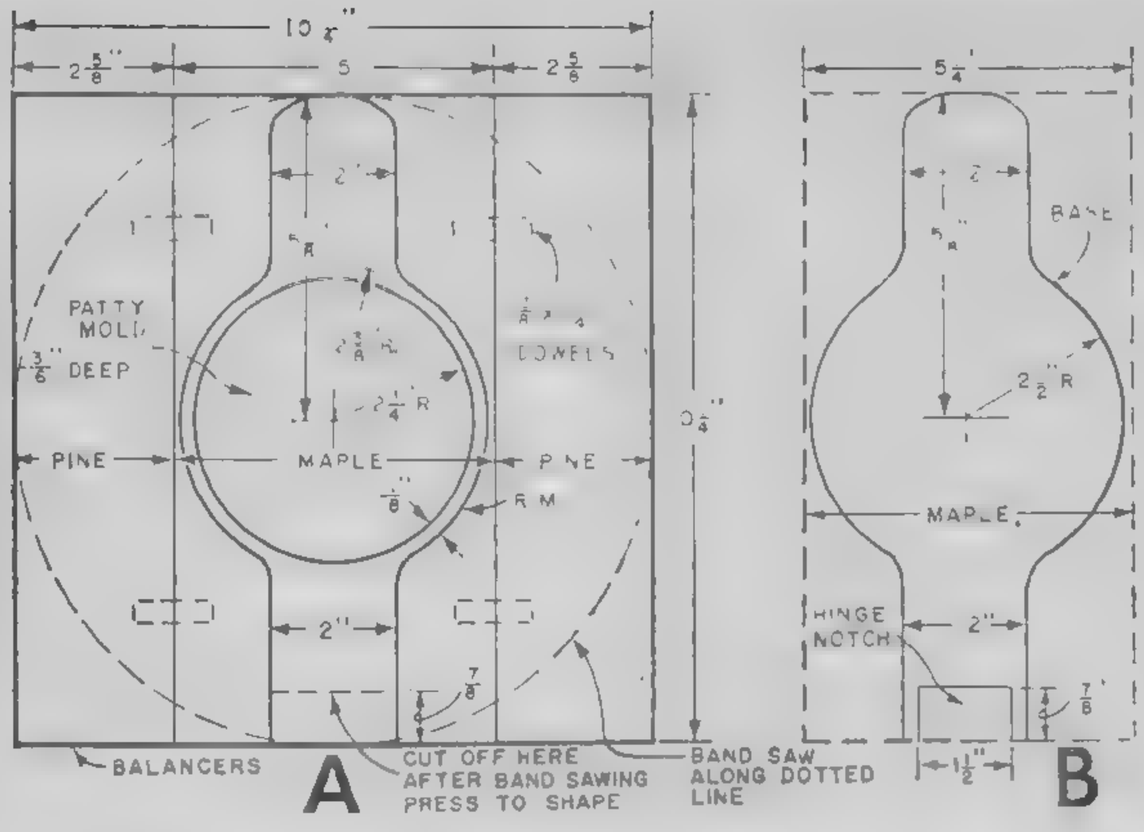
Enlarge screw holes remaining after removal of face plate to ¼-in. dia. and 3/16-in. depth. Then glue-insert ¼-in. dia. x ¼-in. round-topped hardwood plugs (Fig. 3C).

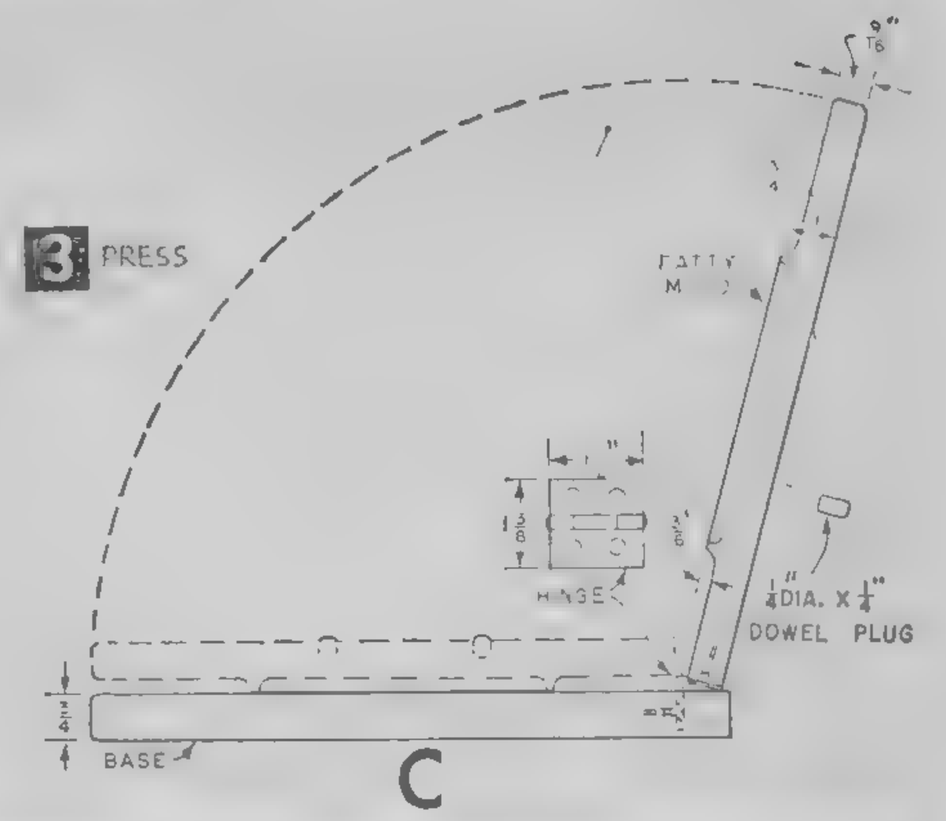


Place section of meat between 6-in. squares of waxed paper and press into shape. Patties in foreground are ready for fire or freezer, purposely oversized to allow for shrinkage in cooking. Wiping with a damp cloth or paper towel after each use will keep press clean.

Bandsaw the base from ¾ x 5¼ x 10¼-in. maple stock to similar shape (Fig. 3B), except that the circular section has a 2½-in. radius. Sand the entire piece smooth with 2/0 and 6/0 paper, then cut a ⅞ x 1½-in. notch in square end to fit brass butt hinge, as shown in Fig. 3B and C. Position press mold over the base as in Fig. 3C, spot screw holes for hinge, drill holes and attach hinge.

For the meat divider (Fig. 5A) scribe a 5⅞-





Dimensions are for press to be used with 3½-in. dia. hamburger buns. For 4-in. buns, add ¼ in. to the 2¼, 2⅜ x 2½-in. radii on top or base; also ½ in. to width of the maple stock and deduct ¼ in. from width of each pine balancer. You'll then get six 'burgers to the pound with 3/16-in. recess; four if you deepen it to 9/32 in.

MATERIALS LIST—HAMBURGER DIVIDER PRESS

No. Req.	Size and Description	Use
1	¾ x 5 x 10¼" maple	patty shaper
2	¾ x 2⅝ x 10¼" pine	work balancers
3	¼" dia. x ¼" long hardwood plugs	screw hole inserts
4	⅜" dia. x 1¼" hardwood dowels	balancer fasteners
1	¾ x 5¼ x 10¼" maple	base
1	2 x 6 x 6" maple	meat divider
1	¾ x 3 x 3" maple	lift for divider
2	¼" dia. x ½" long hardwood dowels, grooved	lift fasteners
1	1½ x 1⅜" brass butt hinge, with *fh* (flathead) screws	
1	small container liquid glue	
	4½ x 5½" sheets 2/0 and 6/0 sandpaper	

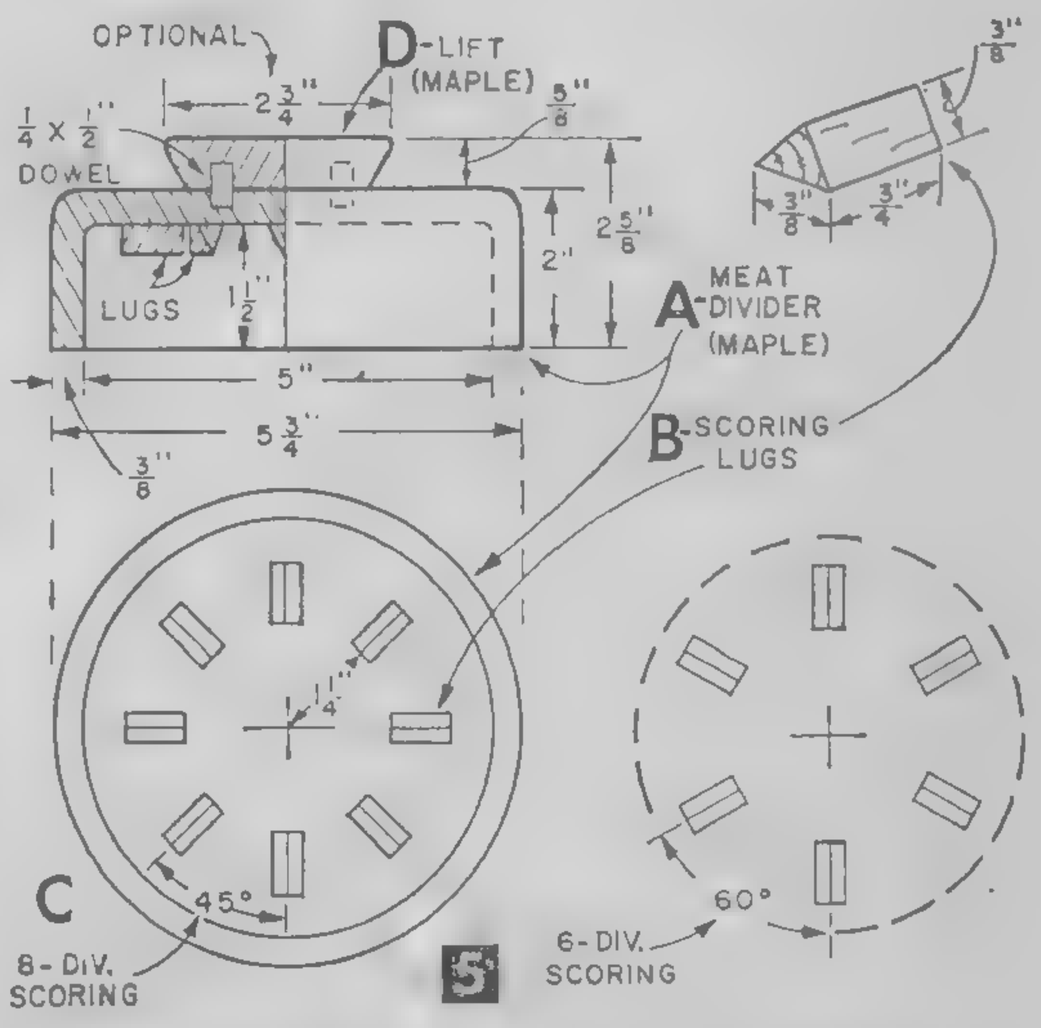
Forming recess in press top with roundnose chisel against rim. RPM speeds suggested for the lathe are: rough cut, 800; finish cut, 1,200; sanding, 1,500.

in. dia. circle on a 2 x 6 x 6-in. maple block and bandsaw along the line. Center a 3-in. face plate on the best-appearing side, using ½-in. #10 *fh* screws for mounting. Attach to lathe. Dress down the periphery to 5¾-in. dia. and round off the edge on face plate side.

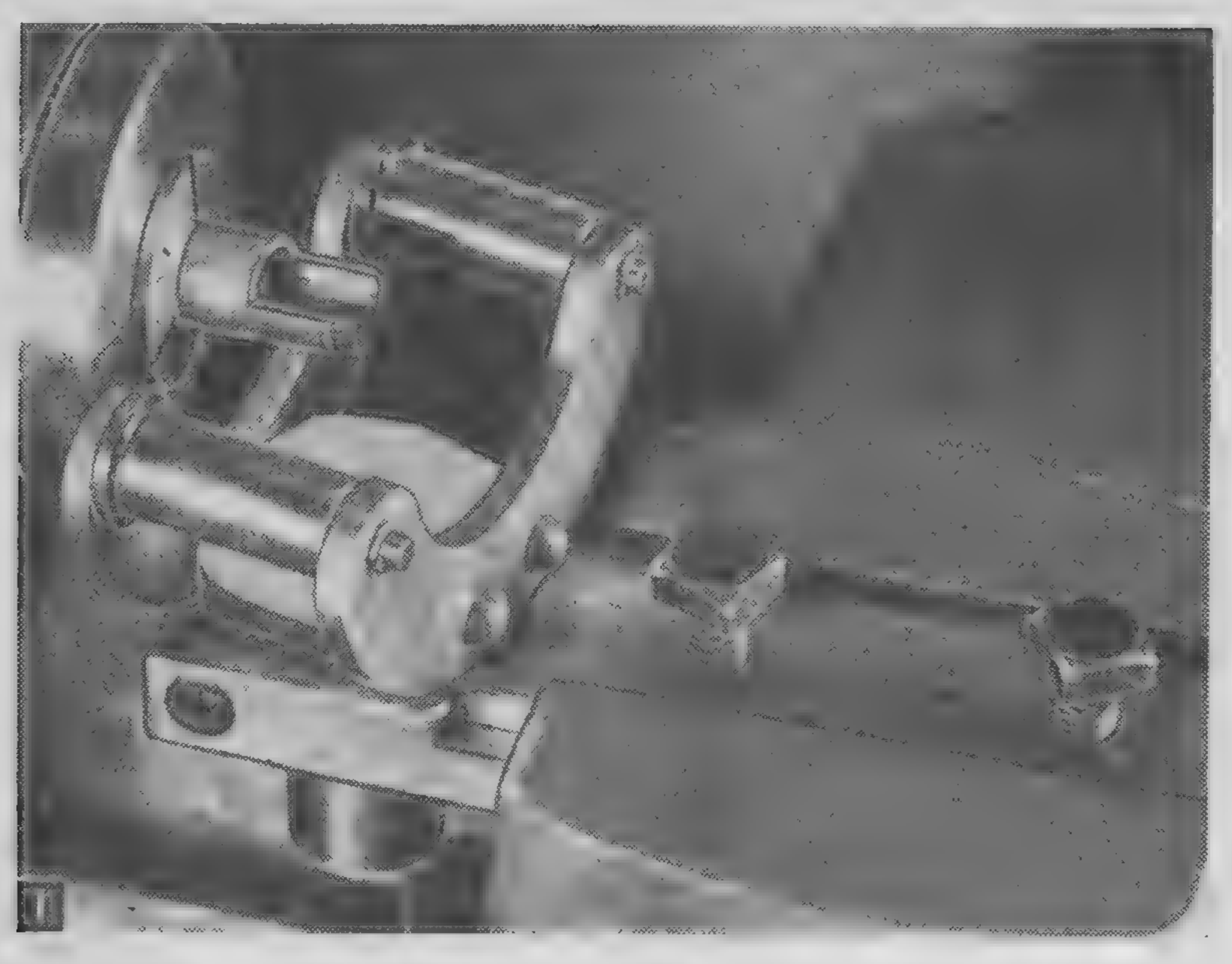
On the face side, form a 5-in. dia. 1½-in. deep recess as shown in Fig. 5C. Sand smooth all exposed surfaces and remove from face plate.

Out of your maple scrap, cut eight triangular pieces, each ¾ in. long with 3/16-in. base and ⅜-in. sides, as in Fig. 5B. Glue these scoring lugs in place within the recess as shown in Fig. 5C, aligning each with diameters 45° apart and set 1¼ in. from the center point.

Diameter of the lift (Fig. 5D) is not critical so long as it covers face plate screw holes. Attach it with ¼ x ½-in. dowels. Slightly round off all sharp edges, including lugs, with 6-0 sandpaper. Finish with clear lacquer or varnish, following manufacturer's directions. —FRANK HEGEMEYER.



Divider in center is designed to mark eight portions to the pound. For man-size, quarter-pound 'burgers, eliminate every other scoring lug. For six hamburgers to a pound, design at bottom eliminates two of the lugs, and spaces remainder at 60° angles.



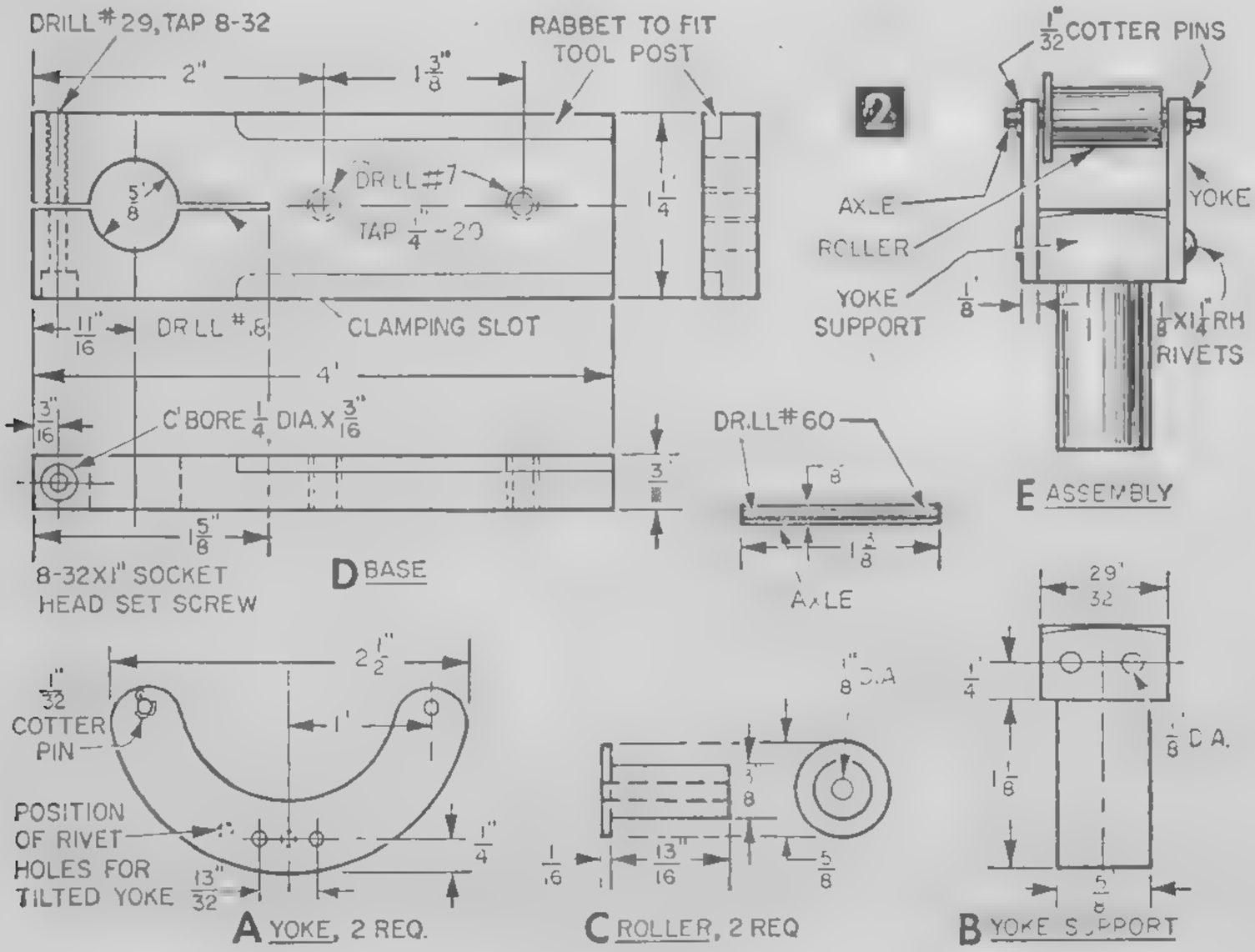
Watchmaker's Filing Guide For Your Lathe

ALTHOUGH you may never have seen one, your grandfather is probably very well acquainted with a filing guide, similar to that in Fig. 1, which enabled him to do simple milling operations with a file long before milling equipment was available for the home workshop.

Originally developed in the watch and clockmaker's trade, it was an important item in every mechanic's tool chest in the early 1900's. The filing guide was used to make set-screw and key flats on round work and, with an indexing arrangement on the lathe spindle, to produce square, hex and other flat-sided stock. Since this guide is much cheaper, handier and easier to set up than a mill, you will find it to be a useful and time-saving tool today.

A bolt, a large washer, a piece of flat steel and a few pieces of drill rod are the major items from which the filing guide is made. The guide (Fig. 1) is designed for a South Bend 9-in. lathe; but alterations in the size of the bolt, washers and mounting plate will adapt it to other lathes.

Make the yoke (Fig. 2) from a $\frac{1}{8}$ x $2\frac{1}{2}$-in. o.d. flat washer. Turn the inside diameter to $1\frac{1}{2}$ in., saw it in half and smooth the edges. The yoke support is turned from a $\frac{5}{8}$-in. dia. square-headed bolt that has at least a $1\frac{1}{8}$-in. unthreaded portion on the body. Turn the body to a uniform diameter (Fig. 3), removing as little stock as possible. Machine the underside of the head and trim two sides of it to provide smooth, parallel sides on which to mount the yoke. Allowing $\frac{1}{32}$ inch for trimming the head, the finished dimension across the flats should be $\frac{29}{32}$ inch. Now cut off the threaded portion of the body, leav-



ing at least 1⅛ in. of machined surface.

Many filing guides were originally made with the back roller somewhat higher than the front to provide a more comfortable position for working. The depth of cut was changed by a backward or forward movement of the cross slide and demanded constant checking of the work. It is suggested, however, that the guide be made with the rollers on a horizontal plane, since the depth of the cut can then be predetermined by inserting pieces of drill rod or shim stock between the mounting plate and the machined underside of the bolt head. This is a personal preference which must be decided upon when attaching the yoke to the support. Broken lines in Fig. 2 represent holes drilled to mount the yoke at an angle.

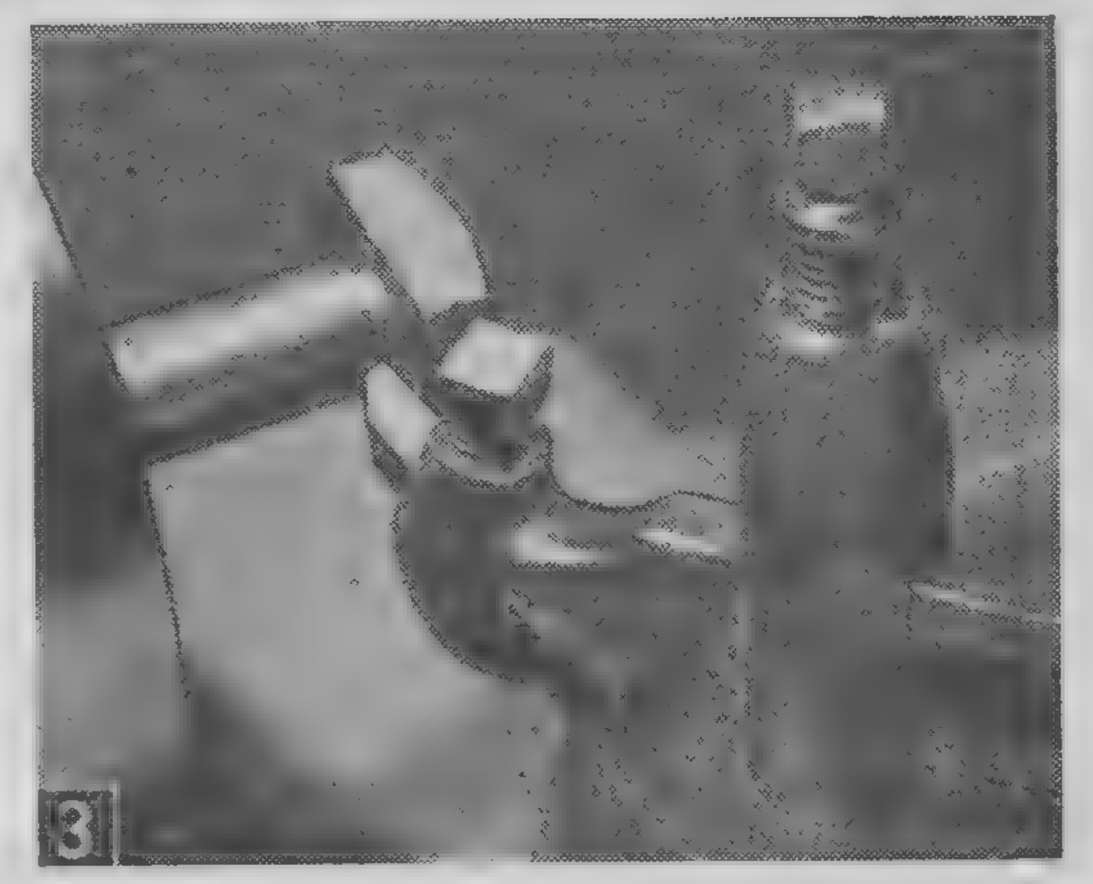
Clamp the yoke sides to the bolt head in the desired position and drill the ⅛-in. rivet holes. Insert a soft iron *rh* rivet in the first hole to hold the parts in place while reclamping and drilling the second. Peen both rivets after the drilling is complete (Fig. 4).

Make the mounting plate (Fig. 2) from a ⅜ x 1¼ x 4-in. steel flat. Mount it on your lathe and bore a hole to fit the body of the bolt snugly. Hacksaw a 1⅝-in. deep clamping slot, passing through the center of the hole. Drill a #18 hole from one edge to the slot and a #29 hole, tapped 8-32, from the other edge to the slot. Rabbet the opposite end of the plate to fit your tool post slide and drill and tap two holes for ¼-20 cap screws to hold the plate in the slide.

Clamp the yoke assembly in the mounting plate and set up the assembly in your lathe. Be sure the sides of the yoke are at right angles to the lathe centers and parallel to each other. Raise the yoke with a 3/16-in. drill rod under each side of the bolt head and then drill through the ends of each yoke with a ⅛-in. drill held in the lathe chuck.

Turn the rollers from ⅝-in. drill rod to fit between the yokes (Fig. 2C), drilling each lengthwise to fit on a ⅛-in. dia. drill rod axle. Heat the rollers to cherry red and quench, *small end first,* in water or oil. Brighten the metal with emery cloth and temper by heating to a straw yellow and quenching again. Drill a #60 hole 1/16 in. from each end of the axles and mount with the rollers in the yoke. Fasten the axles with cotter pins.

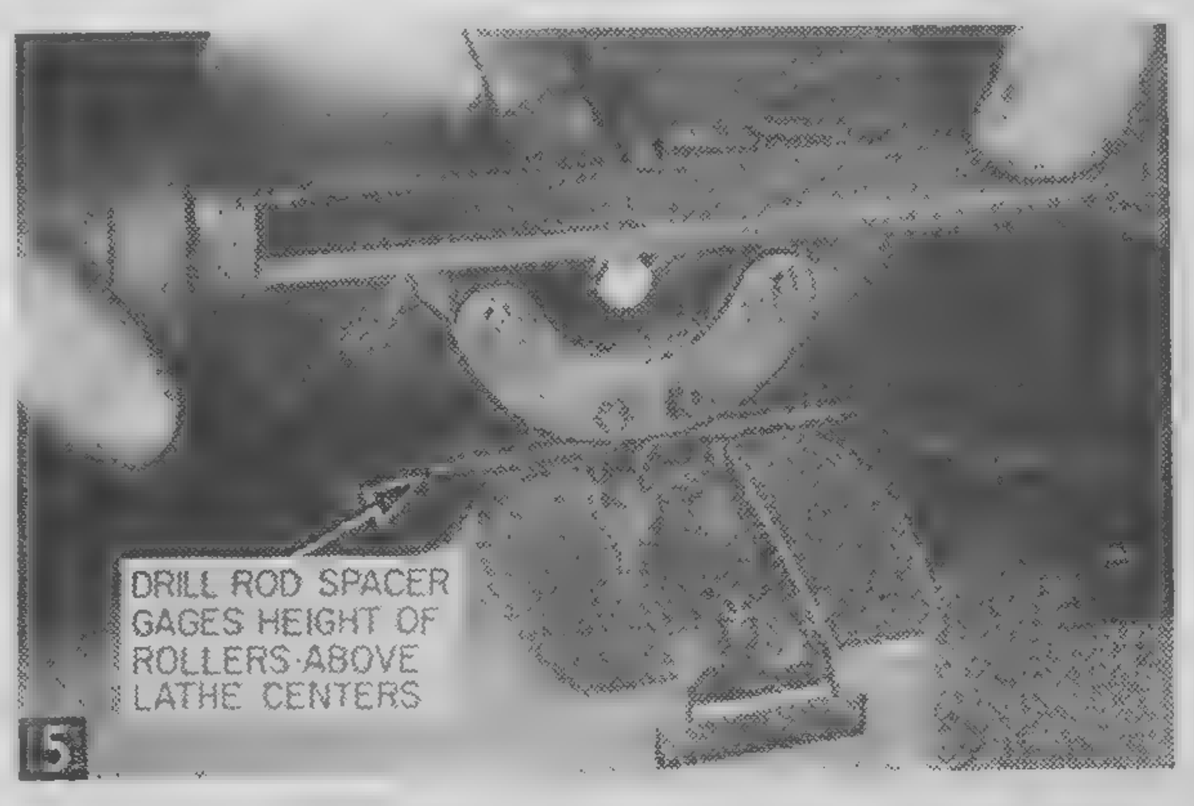
When using the filing guide on symmetrical work such as a hex bolt head (Fig. 5), rough out the work, if necessary, with a hacksaw or coarse file. Then raise the filing guide one-half the finished distance across the flats of the hex and, using an indexing setup, complete the work with a fine, single-cut file.



Yoke support is made by machining the body and head of an ordinary ⅝-in. machine bolt.

Angular cuts are made by pivoting the yoke assembly in the mounting plate and guiding the file along the roller flanges (Fig. 1).—WALTER E. BURTON.

Yoke sides are riveted to support. Yoke assembly and mounting plate are set up in lathe while drilling roller axle holes.



Lathe spindle is indexed and locked against back gears when using filing guide to produce flat-sided work.

Table-Top Loom

Operator has just begun a varicolored woolen muffler. Compact loom less than 15 in. deep will weave material up to 10 ft. long, depending on capacity of cloth roller. Insert shows articles made by Oregon State college students on this loom.

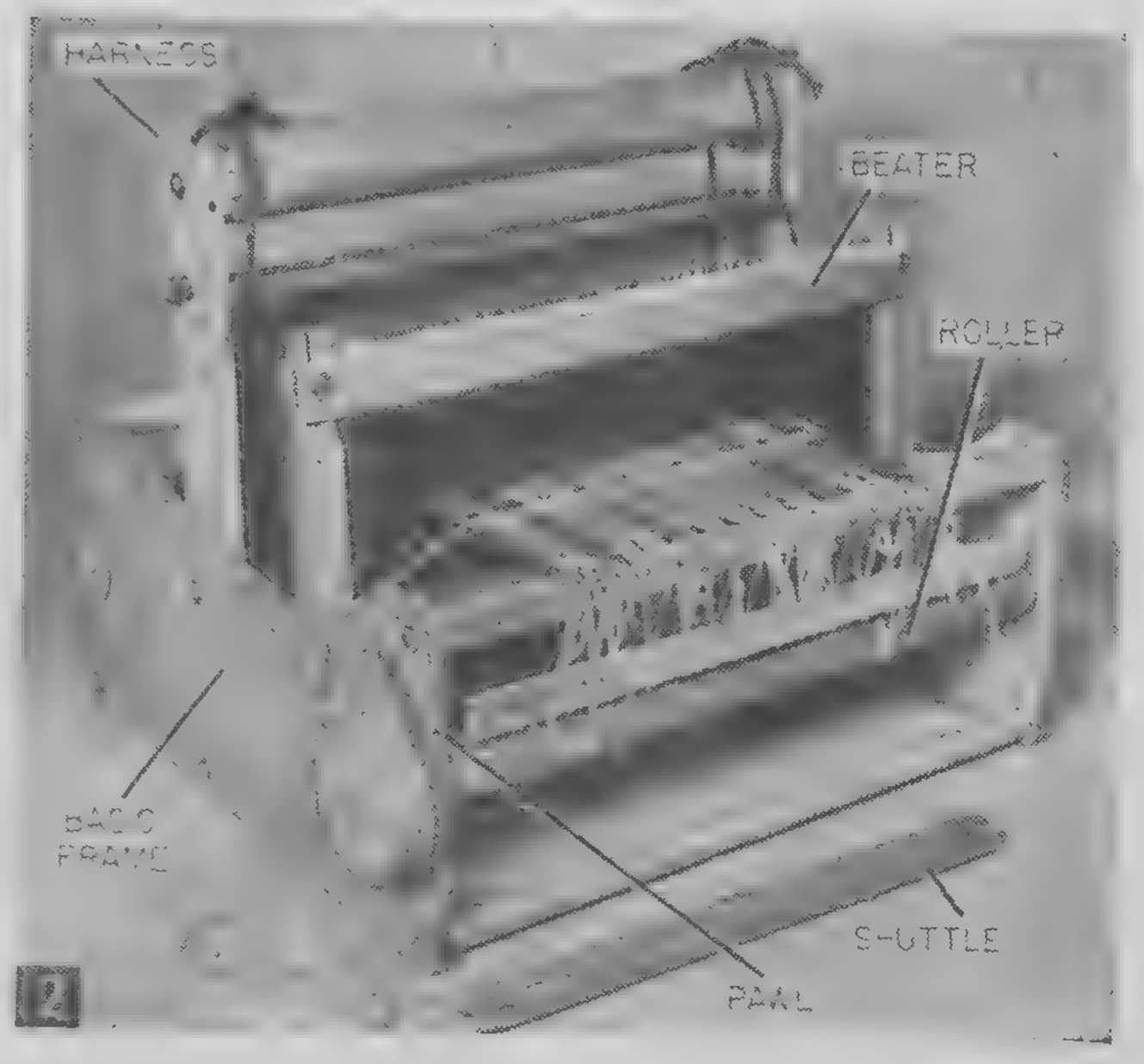
Weave anything from a necktie to a dress with a light "pro" unit you can build for $15

By MILT GRASSELL

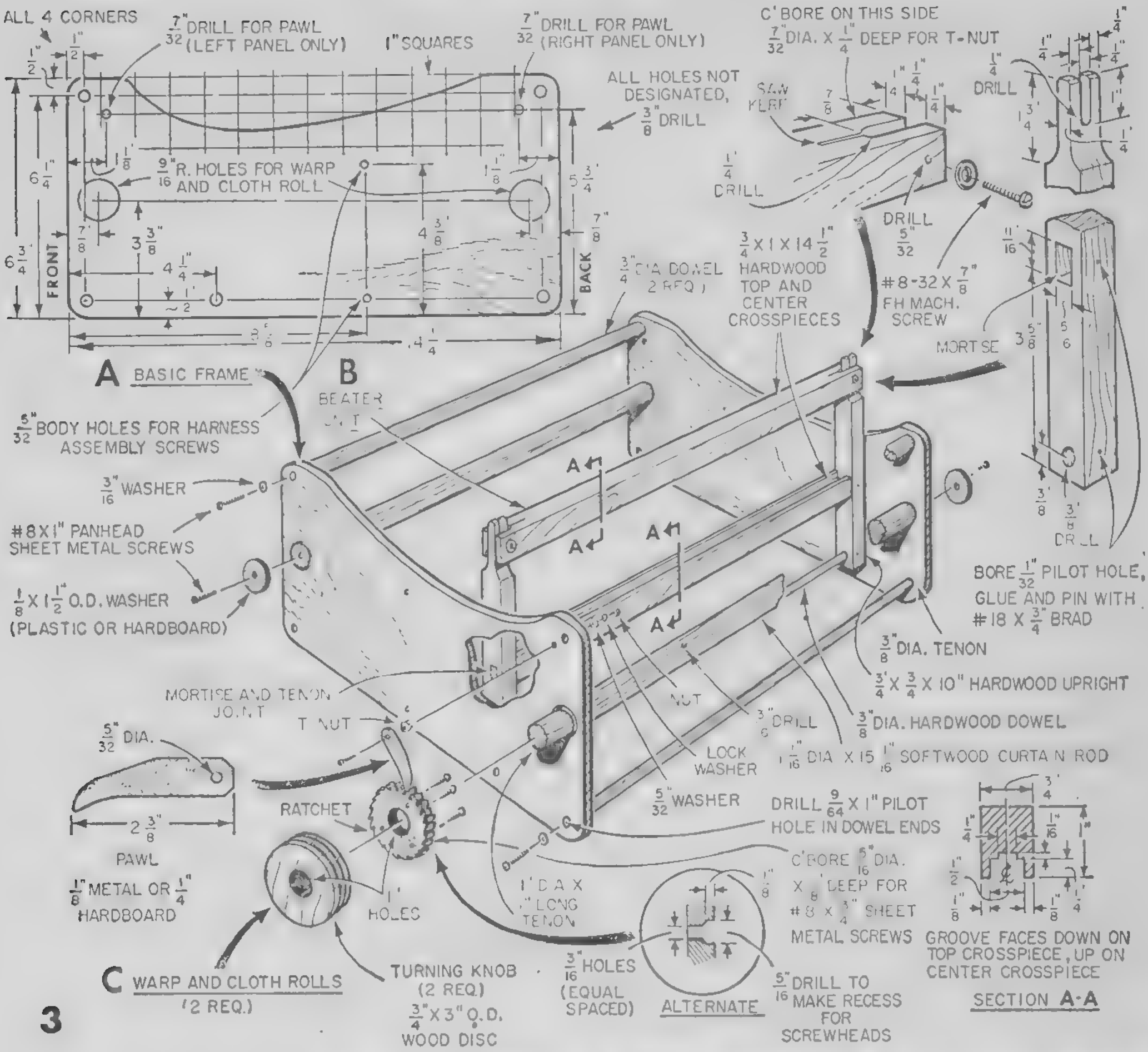
HAVE you ever wanted a small, lightweight loom which would do a creditable job in the hands of a beginner?

You can place the two-harness model in Figs. 1 and 2 on any convenient table and weave top-quality material up to 12½ in. wide and 10 yds. long. Women will like it because it's easy to handle, weighs only seven pounds and requires little storage space. The width is sufficient to make many types of suits or skirts for ladies. And they can even hold it in the lap and weave while sitting in a comfortable chair by the television or hi-fi set.

Professional weavers use this unit as an alternate loom for color planning, sample making, teaching and for numerous small projects. It's as easy and economical to build as it is to operate, thanks to Nelson Fox, the



View of assembled loom, showing the four principal assemblies, pawl location and shuttle which holds the weft thread.



3

hand loom manufacturer who designed it. All the wood needed should not run you more than $1.50 and Fox is making all the metal parts down to the smallest screw available to our readers for $14 postpaid (see Materials List).

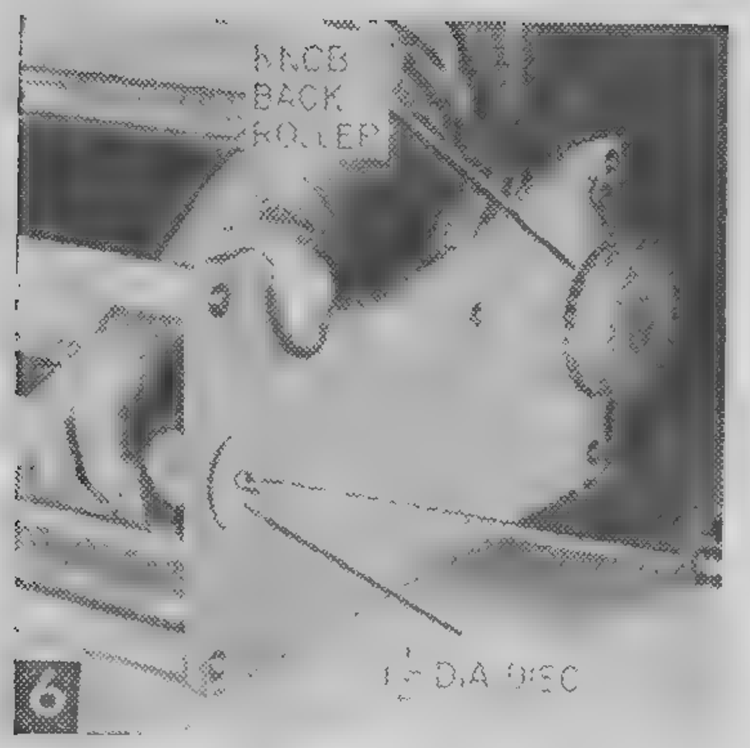
Shaping and Finishing. It's a good idea to shape all the wood parts first to dimensions in the Materials List and Figs. 3 and 7. Drill all holes, round off all edges and sand the pieces smooth to lessen the chance of threads snagging somewhere on the loom during the weaving process. *Caution:* do not use softwood dowels because frame-holding screws may pull out when loom is in use.

4

5

Fig. 4. Hold basic frame open at one end to attach beater by inserting projecting dowel ends in panel holes. Top crosspiece is adjustable for insertion of the reed. Fig. 5. After gluing roller tenon to knob, slip on ratchet to mark knob for screw locations. Drill 1/8-in. pilot holes 1/2 in. deep and fasten ratchet so screw heads are recessed in the counterbored holes.

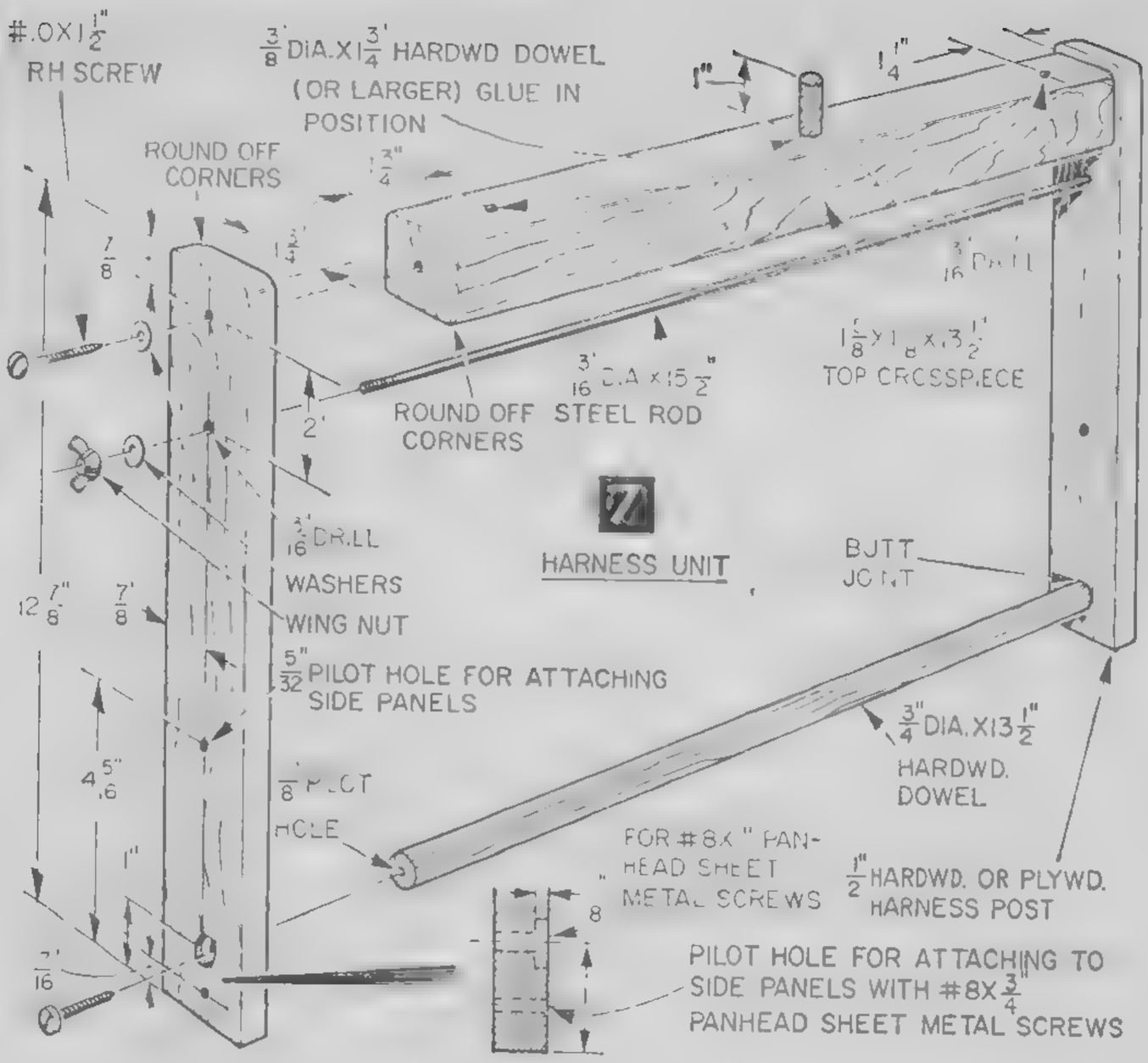
Assembling the Frame. Be sure to cut tenons on dowel ends for a press fit into side panel holes (Fig. 3A) rather than butt dowels against the plywood. You'll need the additional strength of the tenon joints to with-



Installing ⅛-in. thick washer cut from plastic to hold free end of cloth roller in place. Similar warp roller is installed in reverse position across back of frame.

stand warp tension during operation of the loom. If a wood lathe is not available, you can whittle the tenons with a pocket knife. You might also cut them on a circular saw by rotating dowel ends against the protractor head, using the ripping fence as a stop for depth.

Drill 9/64-in. pilot holes 1 in. deep into dowel ends, then fasten dowel crosspieces to panels with #8 x 1-in. panhead sheet-metal screws. However, defer this assembly at one of the front ends until you put the beater in place. Sheet-metal screws are used because their heads are case-hardened and their threads hold better in end grain than wood screws of the same size.



MATERIALS LIST—TABLE-TOP LOOM

No. Req.	Size and Description
1 pc.	¼ x 15 x 15" plywood (side panels, shuttle)
2 pcs.	½ x 1⅝ x 12⅞" plywood or hardwood (harness posts)
1 pc.	1⅝ x 1⅝ x 13½" fir or hardwood (harness top crosspiece)
2 pcs.	¾ x ¾ x 10" hardwood (beater assembly uprights)
2 pcs.	¾ x 1 x 14½" hardwood (beater top and middle crosspieces)
2 pcs.	3/16 x ¾ x 13⅜" pine or fir (apron sticks)
2	¾" dia. x 36" hardwood dowels (crosspieces frame top, harness bottom)
1	⅝" dia. x 36" hardwood dowel (frame bottom crosspieces)
1	⅜" dia. x 36" hardwood dowel (beater bottom crosspiece, harness handle)
2 pcs.	1 1/16" dia. x 15 1/16" softwood curtain rod (warp and cloth rolls)
2	¾" x 1" I.D. x 3" O.D. wood discs (turning knobs)
2	⅛" x 1½" dia. hardboard or plastic discs (roller holders)
1 pr.	40" shoe strings (heddle bar ties)
1	small ball of sack twine (apron strings, heddle alignment)
1	metal parts kit, complete with reed, heddles, pawls, ratchets, rod, screws, nuts and washers (available from Nelson Fox, 2730 Arnold Way, Corvallis, Ore., for $14 prepaid).

The Beater Unit, a framework that holds the reed (Fig. 4), actually beats the weft, or woof, thread across the warp tightly into the cloth. Glue tenons of grooved center crosspiece in mortises of the two uprights and pin in place with a ¾-in. brad as in Fig. 3B. Flathead screws and T-nuts are preferred to attach the top crosspiece to the uprights. While you could use 3/16-in. dia. x 1¼-in. bolts and wing-nuts, threads are more likely to catch on them when weaving.

Insert a ⅜-in. dia. x 15-in. dowel through bottom holes of uprights to allow a ⅜-in. projection on each side. Drill 1/32-in. pilot holes clear through uprights and dowel, so brad may be backed out if necessary at a future time. Pin in place by inserting brad.

Loosen adjustable top piece to insert the reed in the crosspiece grooves and fasten in place. Now you can install the completed beater assembly in the frame holes as in Fig. 4 and lock it in position by completing assembly of the basic framework.

Warp and Cloth Rolls are identical, each made from 1 1/16-in. dia. curtain rod as in Fig. 3C. Place in your lathe and turn a 1-in. dia. x 1-in. long tenon on one end of each for a press fit into center holes of the wood discs cut as turning knobs. Glue pieces together and reinforce each assembly by pinning with a 10*d* nail. Cut head off nail and tap all of remaining length into pilot hole drilled across knob and through the rod.

Each roller needs a pawl and ratchet. Though you get these in the metal kit, you can make them from ¼-in. tempered hardboard as in Fig. 3C. Fasten each ratchet to a knob with three #8 x ¾-in. sheet-metal screws as in Figs. 3C and 5. Make the two pawl assemblies as in Fig. 3C and attach to basic frame as in Fig. 2. To make sure the

pawl will work freely, fasten the machine screw tightly into the T-nut, back off ½ turn, then lock in place with hex nut at end.

Now insert warp and cloth rolls in their side panel holes, holding pawls over them until ratchets are in place. To hold rollers in position, cut two 1½-in. dia. discs out of ⅛-in. hardboard, plastic, metal or other rigid material. Drill disc centers with shank holes for a #8 x 1-in. panhead sheet-metal screw and install on roller ends as in Fig. 3C. Note that discs should not rub tightly against the side panels or they will interfere with roller action. (Fig. 6).

Harness Assembly. Glue the dowel handle in the center of the 1⅝ x 1⅝-in. top crosspiece, then attach this member with handle up to the top of the hardwood uprights as in Fig. 7. Center drill ⅛-in. pilot holes in ends of the ¾-in. dowel cut for the lower crosspiece and butt against uprights in position for fastening with screws whose heads are recessed in the uprights.

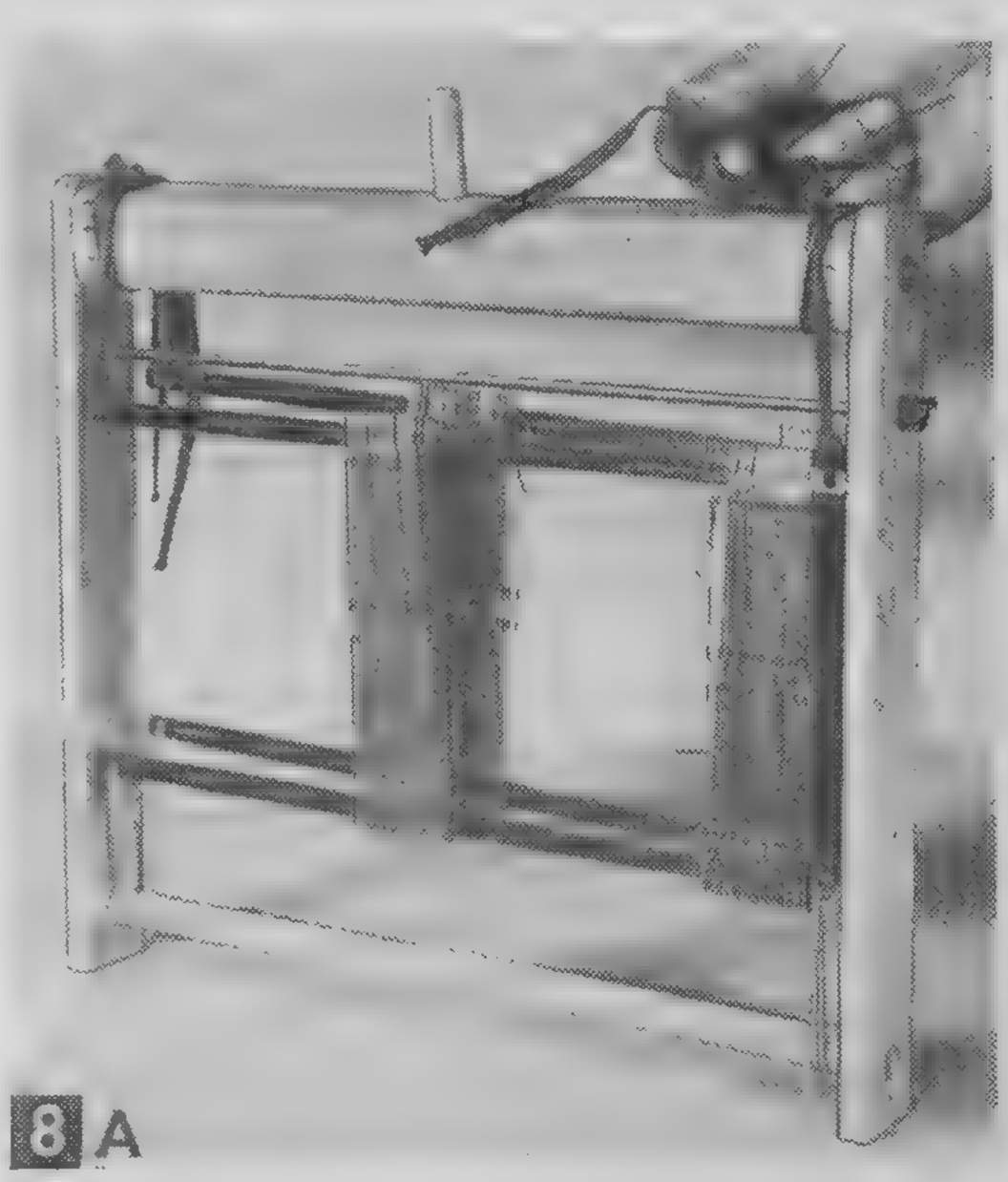
Slip the 3/16-in. steel rod through holes in uprights as in Fig. 7, and fasten with wing nuts on each threaded end. This rod acts as an adjustment providing added friction when the weaver wants the warp shed to remain open while doing lace weaves.

Now you are ready to install the heddles which, like the reed, are something you buy and do not attempt to make. Align heddles together, then slip the wavy ends of half of them over each top heddle bar as in Fig. 8B. Use two 40-in. shoestrings to hold them in place on the harness frame as in Fig. 8A. Cut a string in half, then tie cut ends to eyes at one end of the heddle bars. Run each string around and through top crosspiece as in Fig. 8C. Repeat process at other end of the bars, then adjust strings until the bars are level and secure temporarily with bow knots. Tie bottom heddle bars temporarily with sack twine as in Fig. 8B.

You can now place the harness in the framework. Secure it as in Fig. 3A, using #8 x ¾-in. panhead sheet-metal screws. If you haven't prefinished the wood, this is the time to treat it to keep slivers at a minimum. Sand parts smooth and apply a clear penetrating lacquer. Build up with a spray-on gloss lacquer or brush-on varnish. Paint is not recommended here.

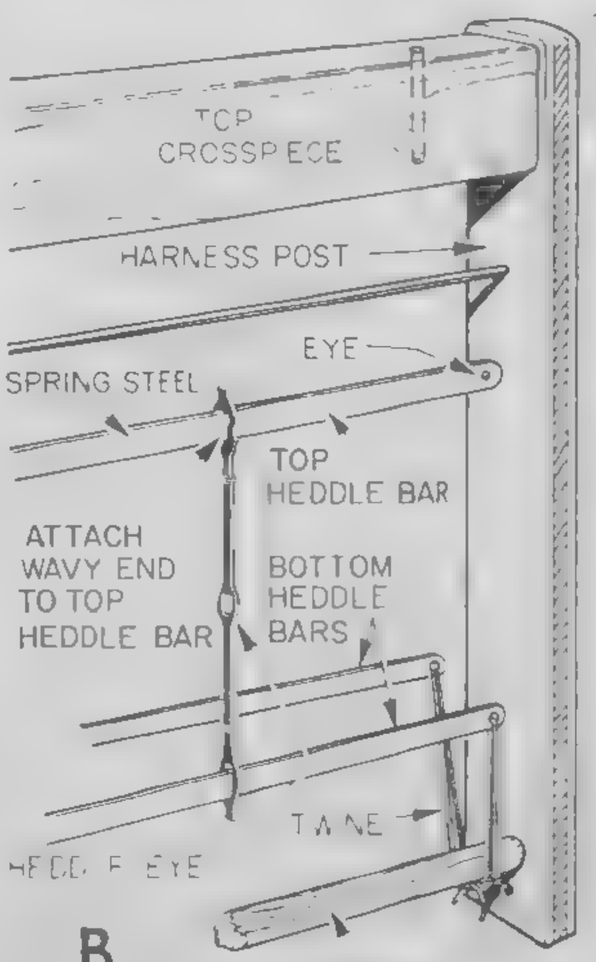
Heddle Alignment. The apron sticks are attached next. Cut two 48-in. lengths of sack twine and form a loop with each string by tieing ends together. Shape a small hook on a short length of wire to pull a string through the holes of each roller as in Fig. 9B. You can straighten out a paper clip and rebend it for this job. Now insert a 3/16 x ¾ x 13⅜-in. apron stick through the two bights of each string as in Fig. 9C.

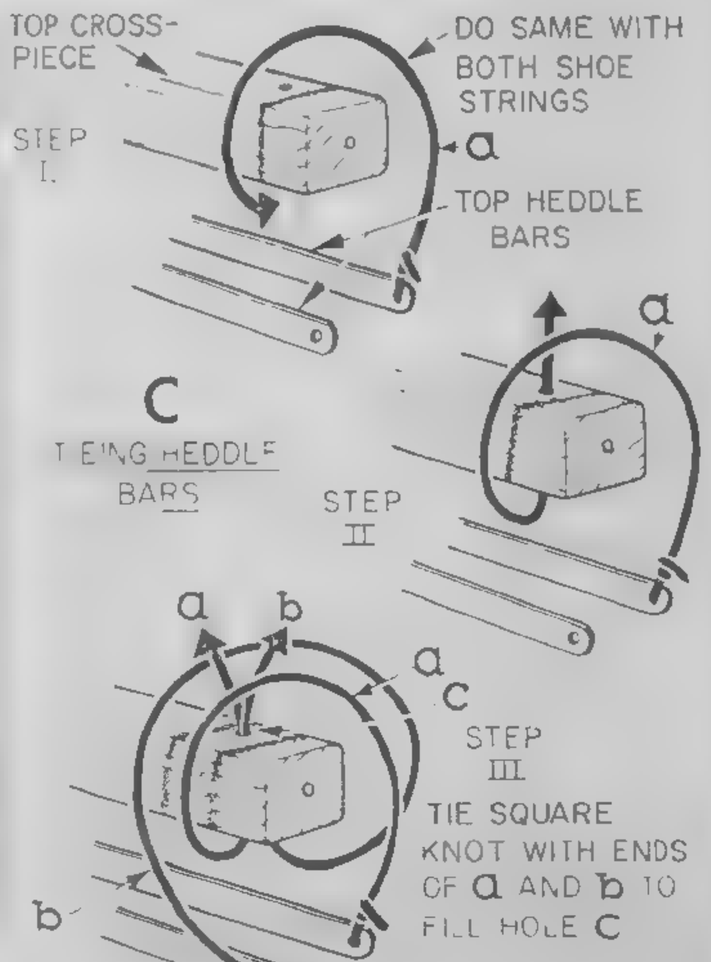
Cut two more lengths of twine, about 30 in., and tie one end of each to the center of an apron stick. Pass them through the reed and eyes of center heddles as in Fig. 9A and C. Tie other ends to center of other apron stick and turn roller knobs until strings are taut. With crosspiece handle in vertical position, adjust shoestrings until the twine passes through the middle of the heddle eyes as in Fig. 9C. Re-tie the shoestrings, using square knots, followed by bow knots to take up any extra length. Re-tie the bottom heddle bars

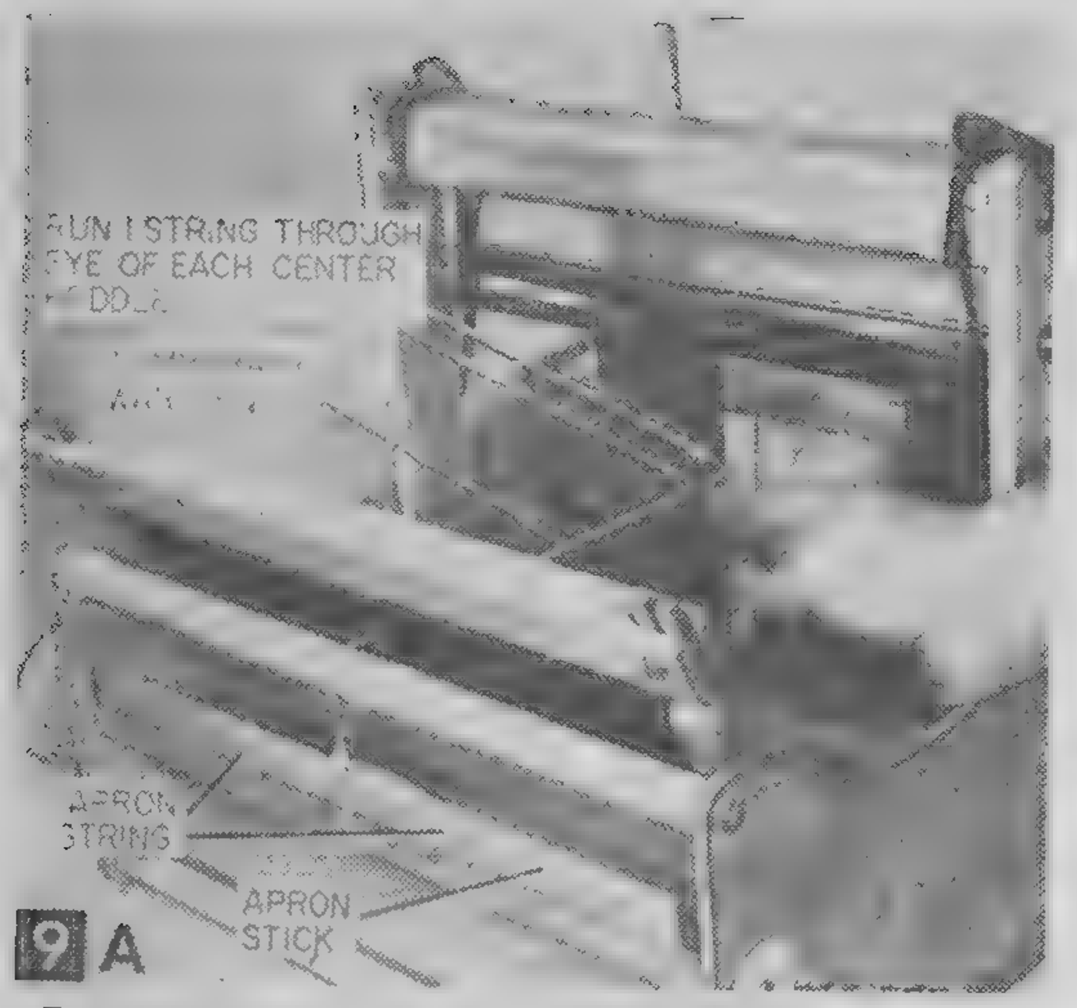


8 A

Two-harness unit is assembled complete before attaching to framework, except for final adjustment of heddle bars. Half of the heddles furnished are placed on each set of bars, wavy end up.

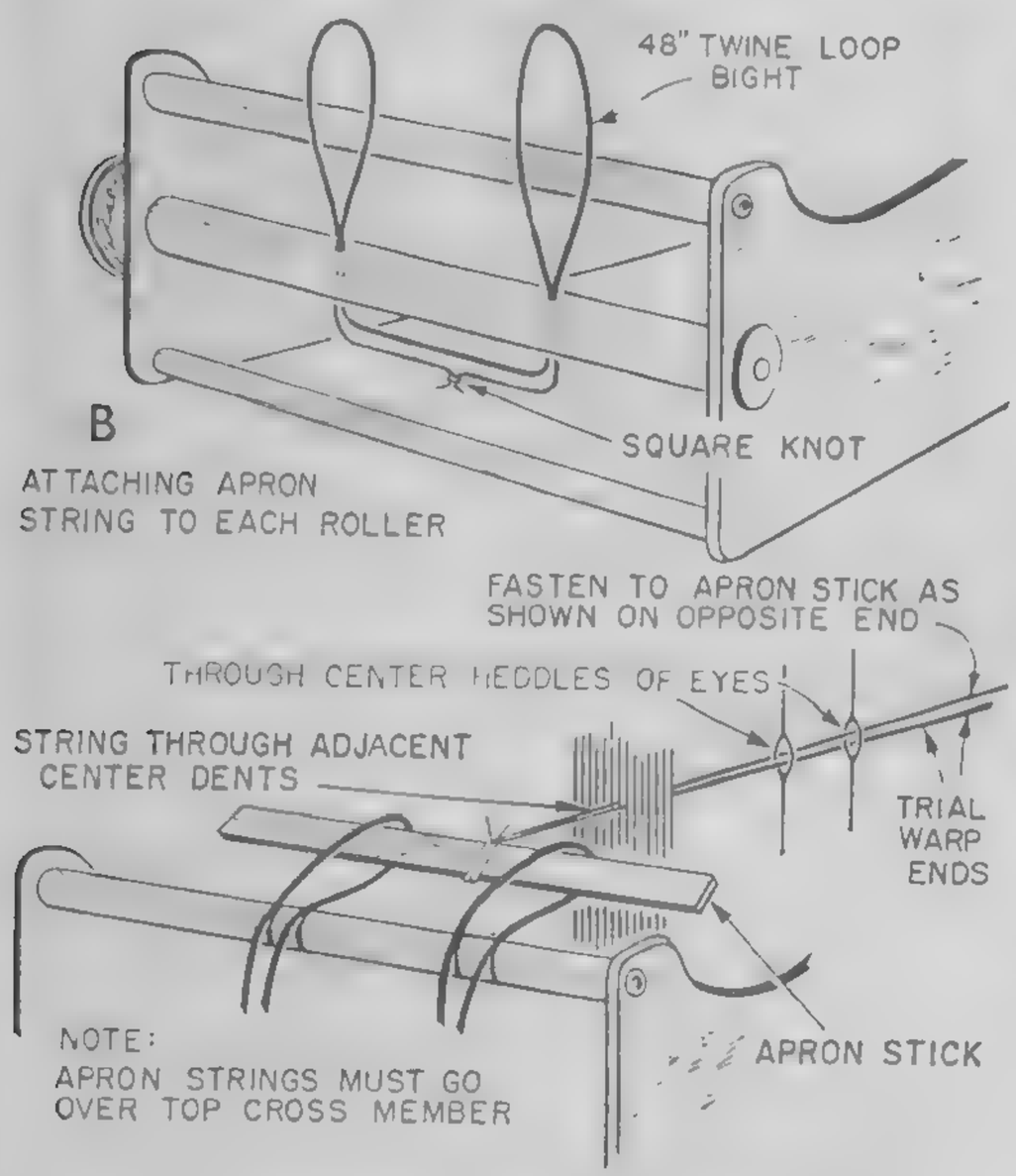






A

Two temporary warp ends (heavy twine) attached to apron sticks are threaded through two adjacent dents in beater unit. One is threaded through eye of center heddle in front row, the other through eye of center heddle in rear. Adjust laces until each warp end passes through middle of eye with heddle bars parallel at same height.



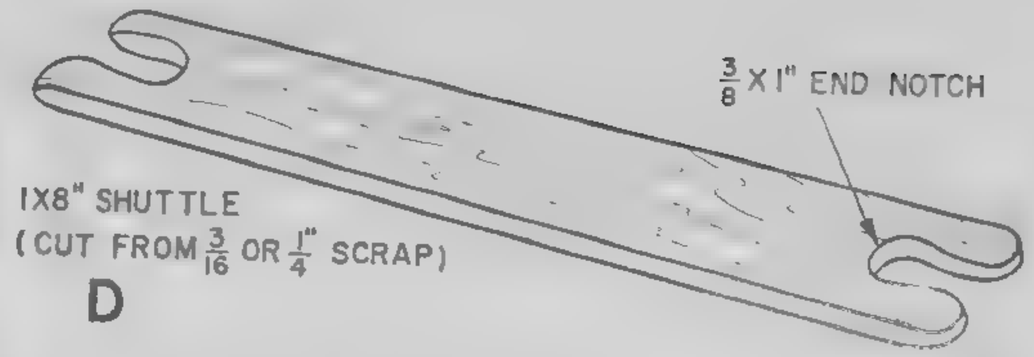
B

C TWO-HARNESS HEDDLE ALIGNMENT

as in Fig. 8C, just enough to take out any slack.

Now that your table-top loom is completed, make up a shuttle (Fig. 2) to hold the weft thread which crosses the warp (lengthwise) thread in a woven fabric. You can use any piece of scrap material about 8-in. long and 3/16-in. thick, shaping and smoothing as in Fig. 9D.

The actual weaving process is not difficult, once you know how, but it is beyond the



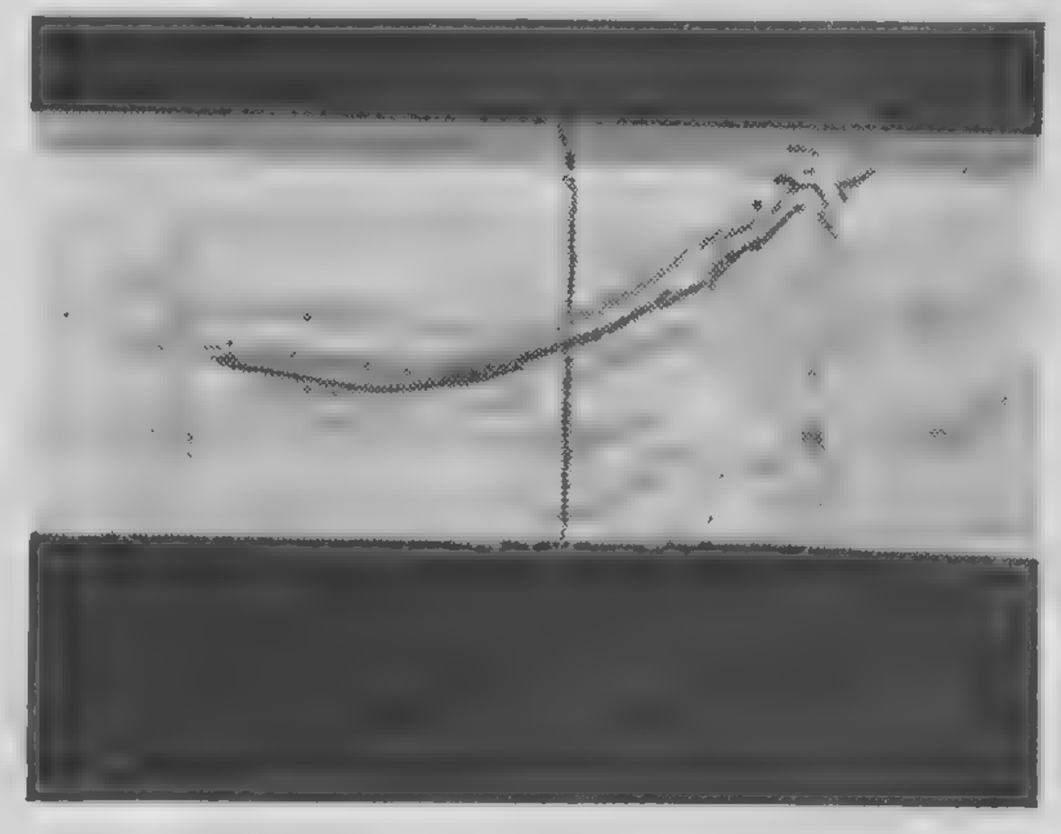
D

scope of this article. However, there are several good texts on weaving available at your library or local bookshop. Among them are: "New to Weaving" by Mary E. Black (Bruce Publishing Co.); "Weaving" by Roger Lewis, 1950 (Knopf, $1.75); "Handweaving: Design and Illustration" by Lotte Becker, 1955 (Crowell, $7.50); "Byways in Hand-weaving" by M. M. Atwater, 1955 (Macmillan, $8.50).

Weaving clubs are flourishing in many communities. Most of them welcome new members who wish to become proficient in weaving their own materials.

Guided Nails

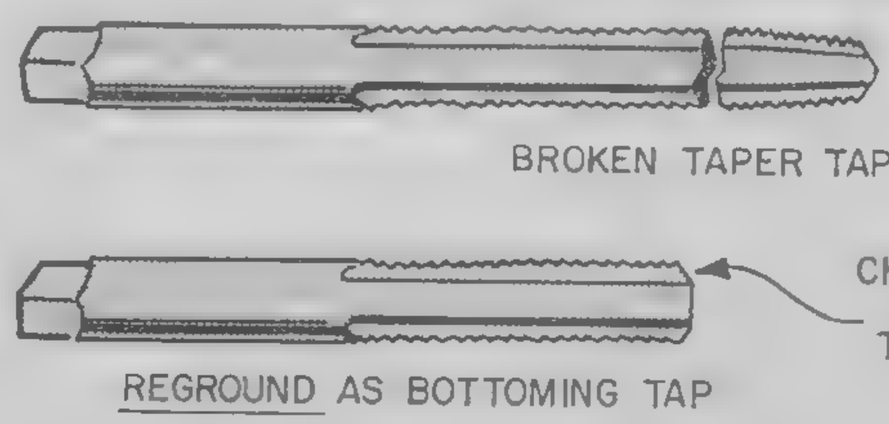
• Usually you want nails to go in the direction you drive them. But on end-to-end joints and toe-nailing with the grain, a nail that can change direction will give you a stronger



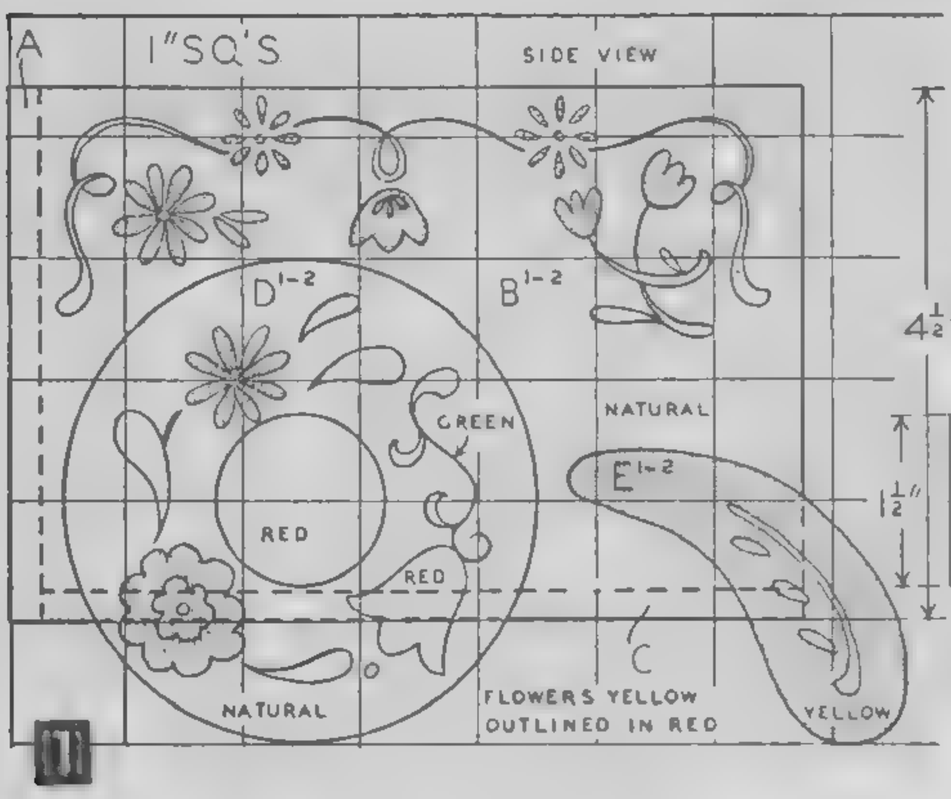
joint. Before driving the nail, bend the tip just a bit in the direction you want it to go and it will follow that course.

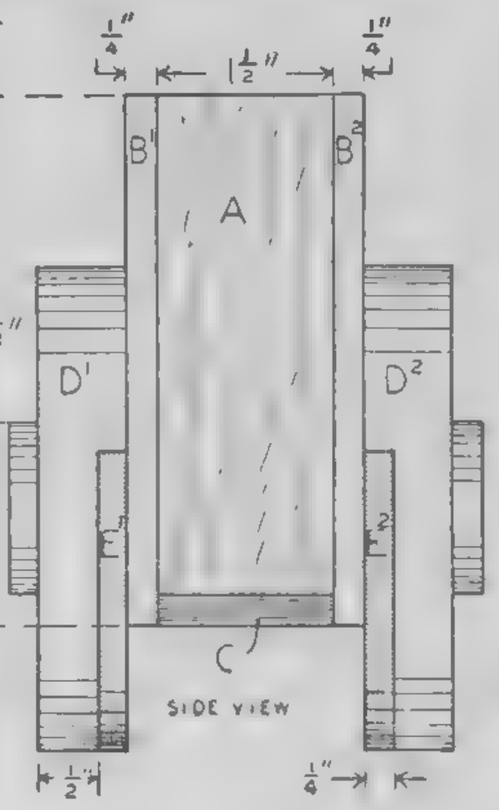
Salvaging Broken Taper Taps

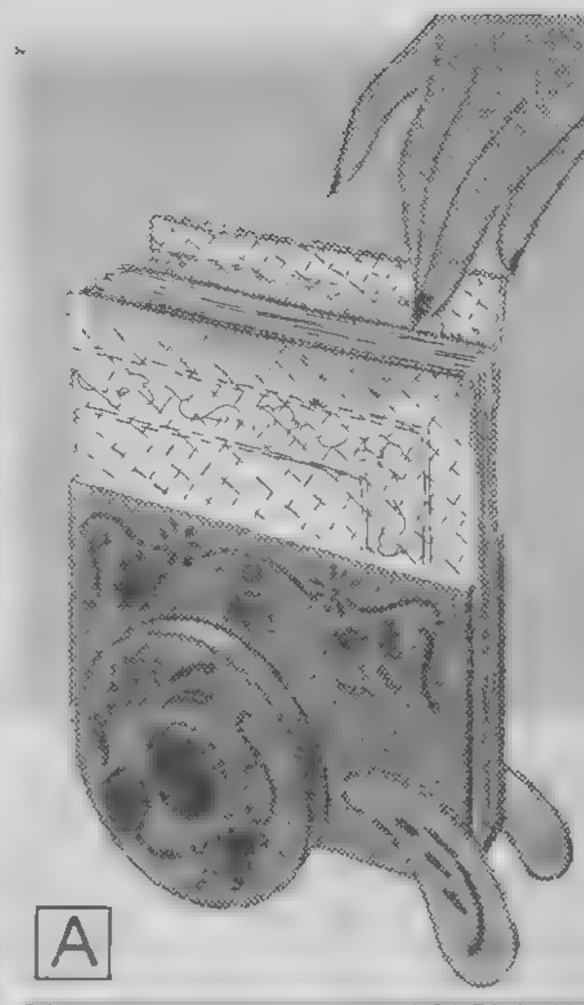
• Those broken taper taps can often be reclaimed and used as bottoming taps. Grind the broken end flat on a 40-70 grit wheel and,



using another bottoming tap as a model, chamfer the first thread on the reground end of the broken tap.—R. W. TIPTON.







Four Napkin Holders

A

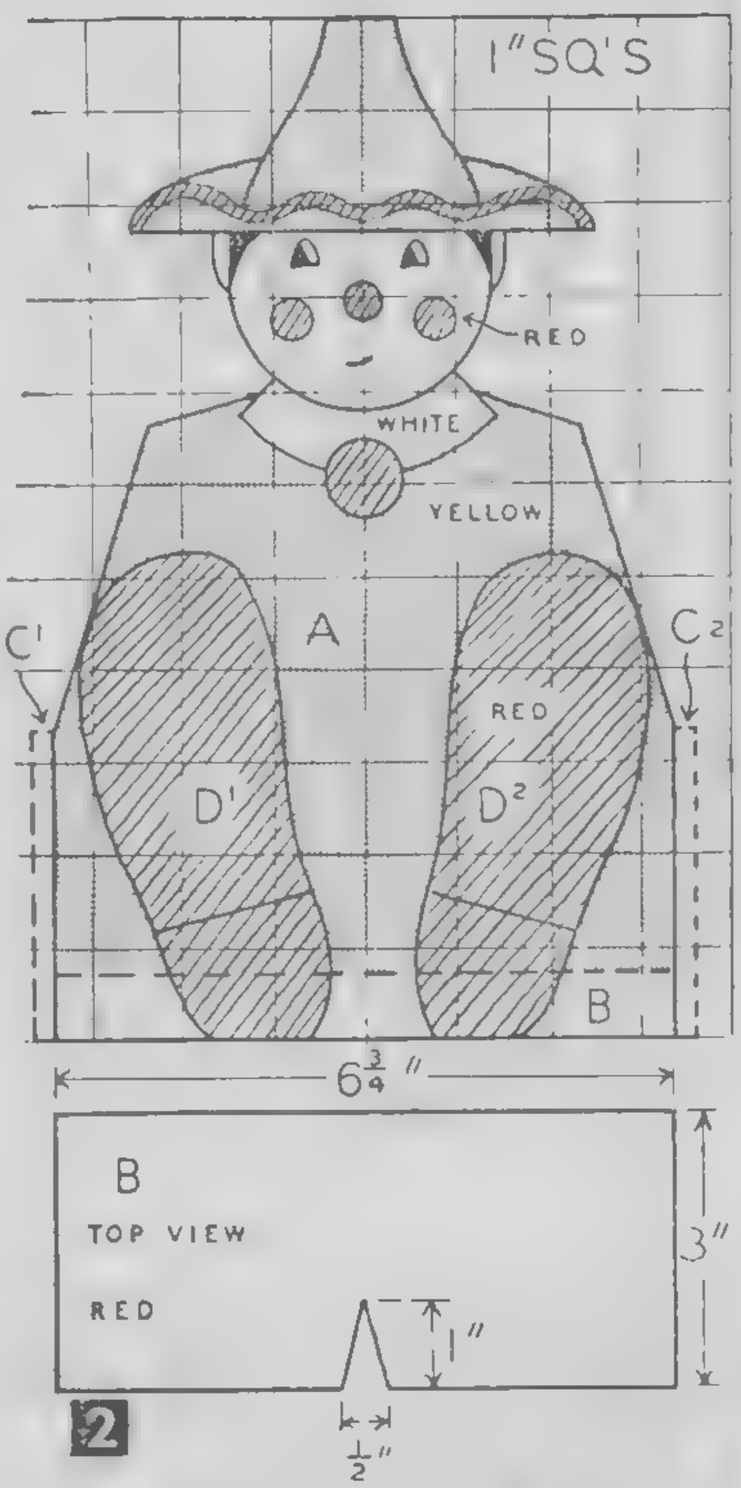
By ROBERTA L. FAIRALL

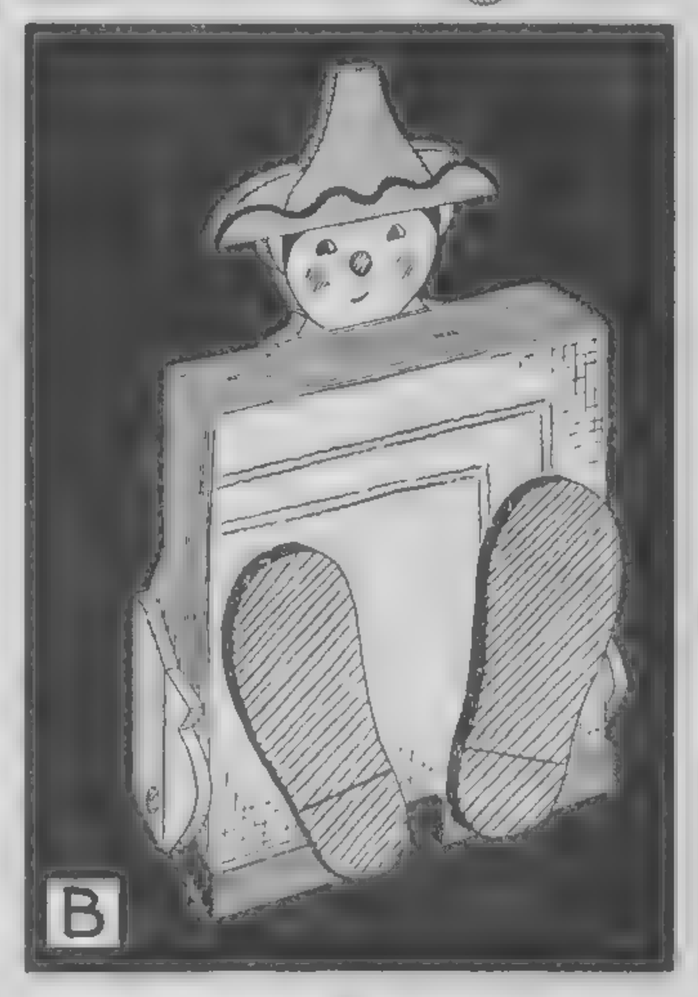
YOU CAN glamorize the prosaic paper napkin a bit with any of these gay little holders. Scraps of ¼-in. and ¾-in. plywood from around your shop, glue, brads, varnish and tube oil colors are all you need.

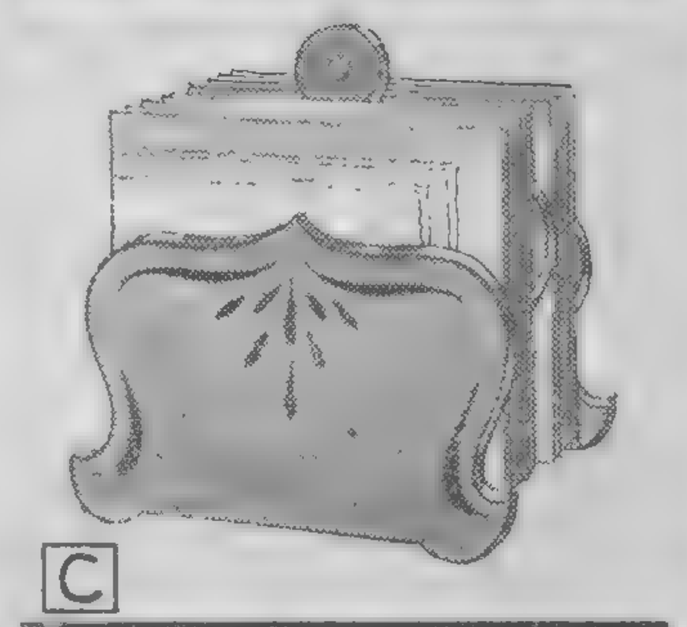
Enlarge the designs on paper ruled in 1-in. squares. Trace patterns to plywood, using carbon paper and a hard lead pencil, and jig-saw out. Glue and brad all joints.

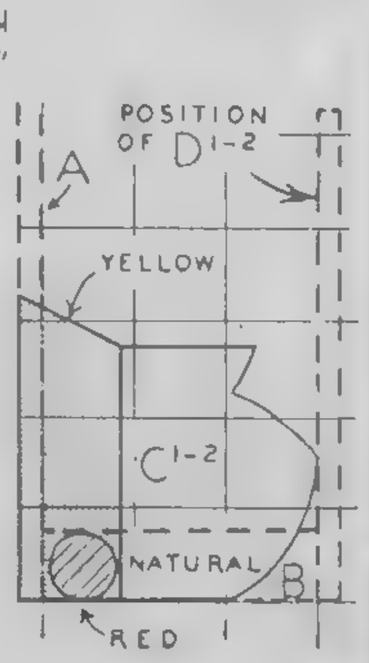
The *decorated cart* with stationary wheels (Figs. A and 1) carries half a package of napkins. Join hubs to wheels and legs to sides, then sides to wheels and position floor section. Give the cart a "wash" coat of white shellac and two coats of clear spar varnish. Decorate with colored enamels after the varnish has dried. Let one color dry before another is painted next to or over it. For enamels, mix tube oil colors in a "medium" of spar varnish.

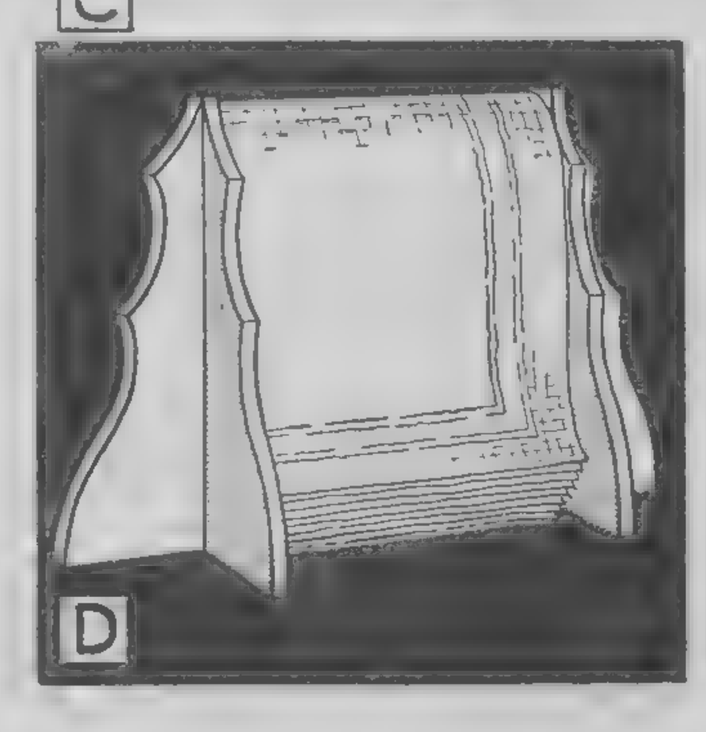
The little *wooden doll* (Figs. B and 2) holds a full package of napkins with the help of his big feet. Finish in the same manner as the cart. Leave hands and face the natural color of the wood. For a more *conventional design* (Fig. C), cut a ¼ in. dado ⅜ in. deep in the base section and glue in the handle section. Stripe edges with red enamel. Napkins hang over top of *fourth holder* (Fig. D). Slip notched sections together, then enamel.

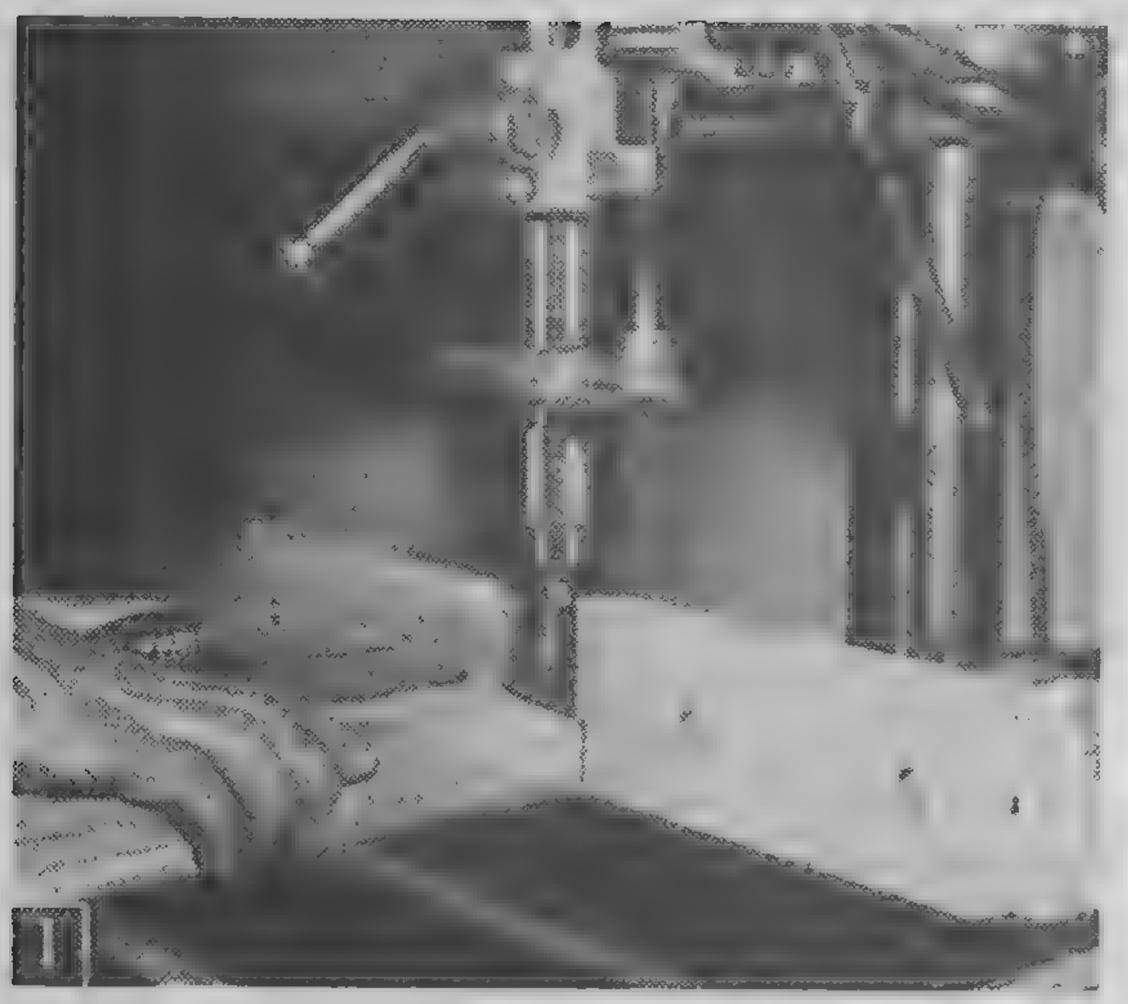


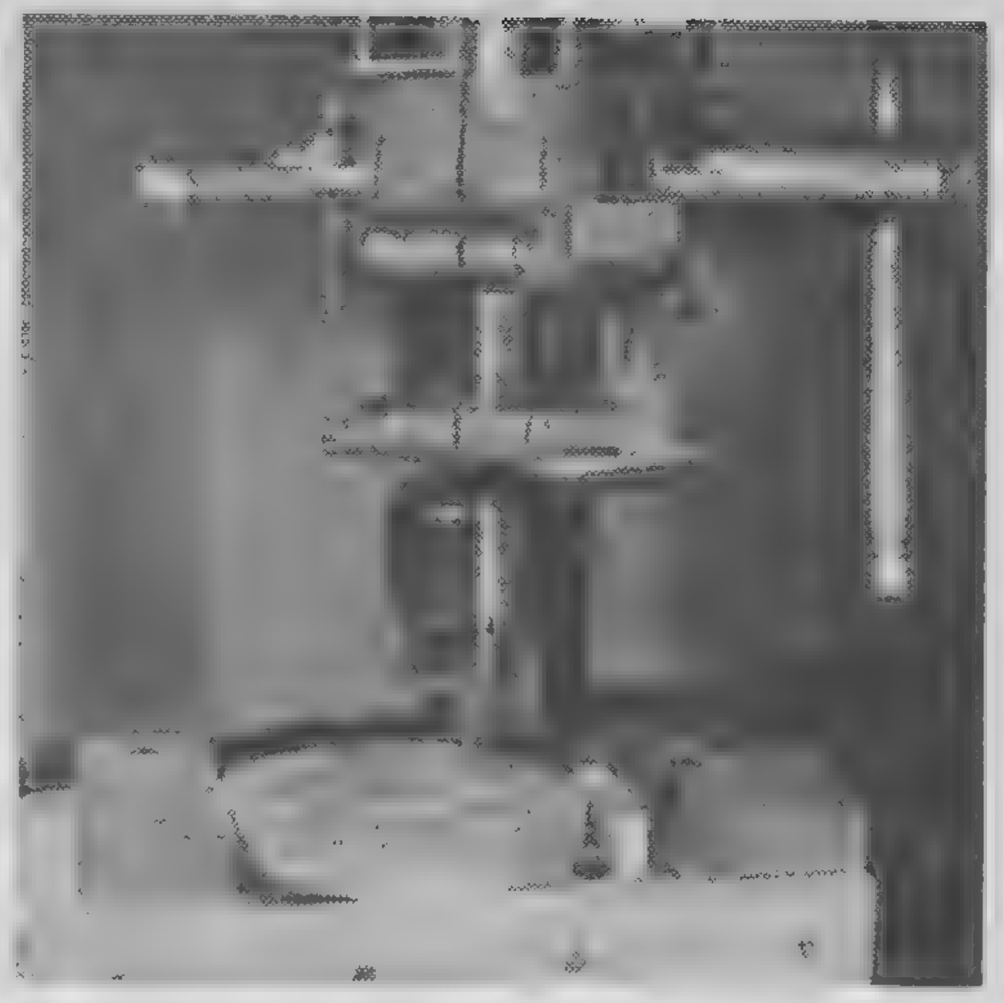












Clamp-on Shaper and Router

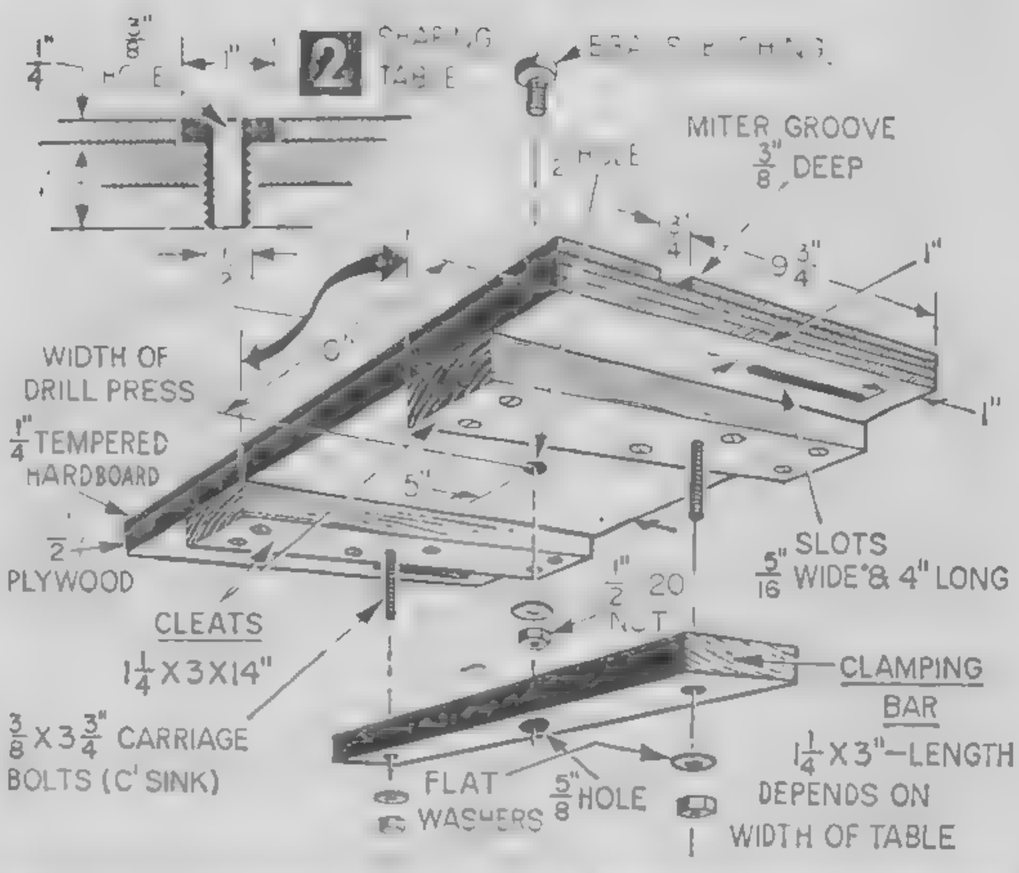
for your Drill Press

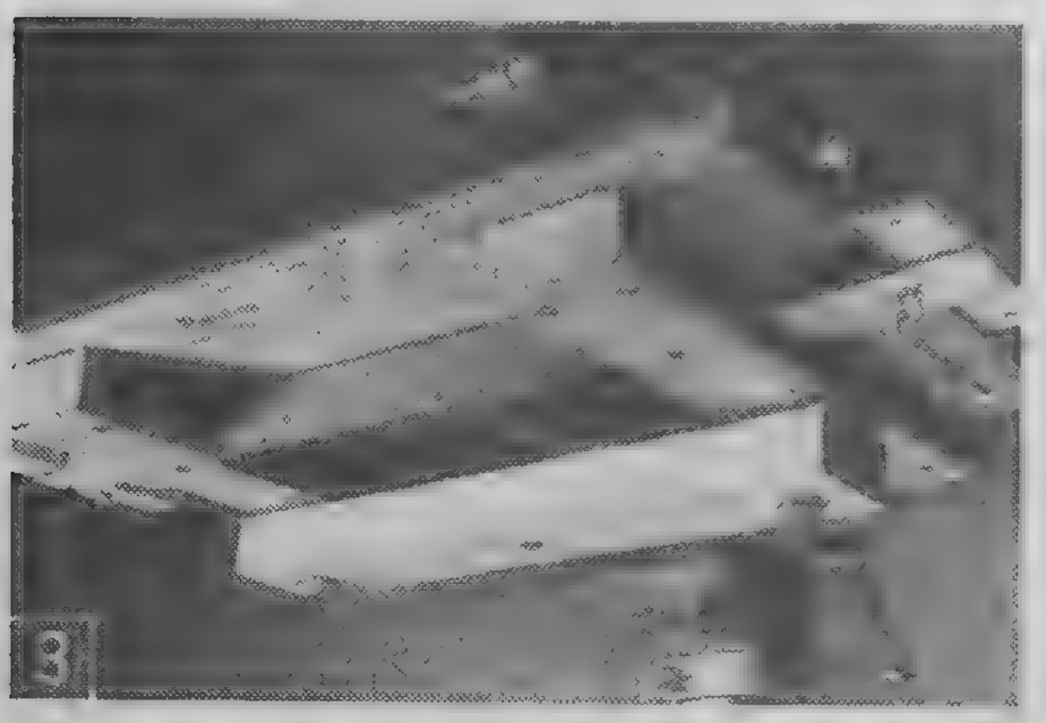
By CARLETON A. PHILLIPS

YOU can convert your drill press to a shaper whenever you wish with this set of accessories that includes a shaper table, arbor and bushing, auxiliary table, and column clamp.

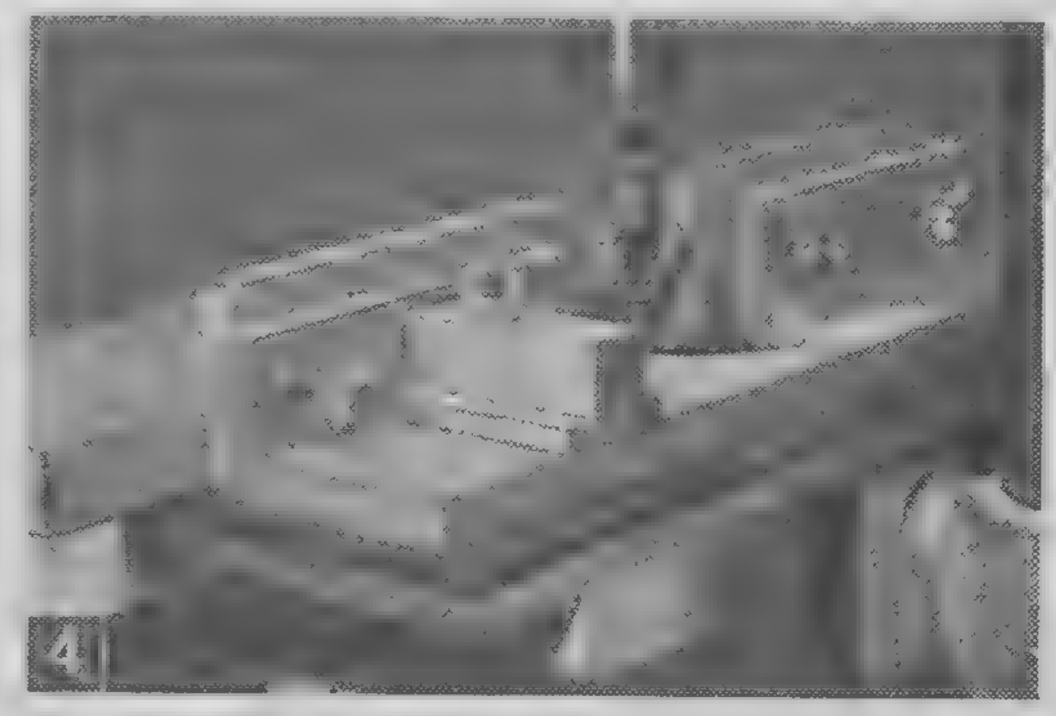
This equipment allows quick conversion for shaping operations without making changes in the drill-press spindle or chuck. The lower end of the shaping arbor runs in a built-in bushing which absorbs side pressures and prevents loosening or slippage of the tapered drill chuck shank.

Construct the shaping table by glueing ¼-

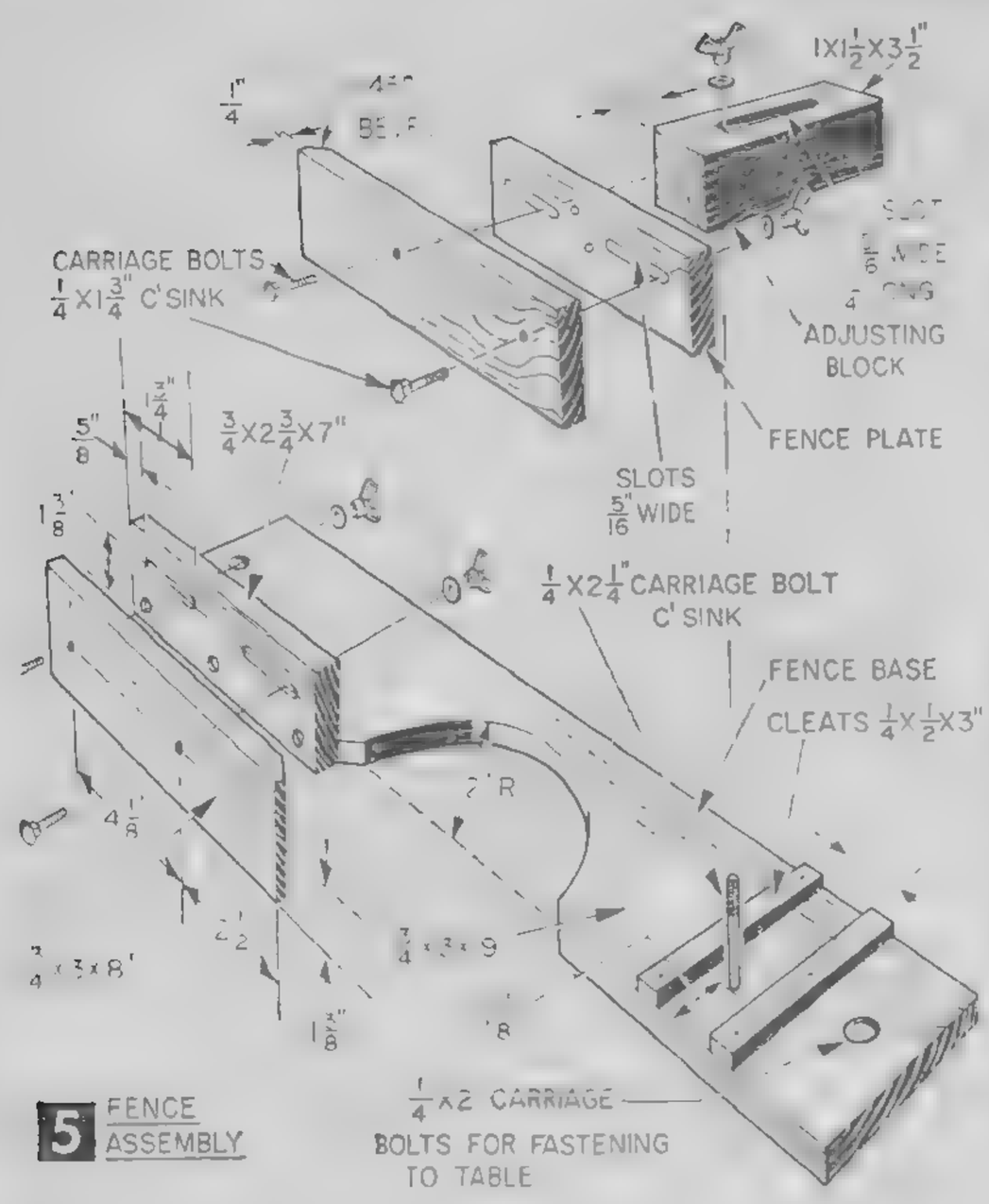




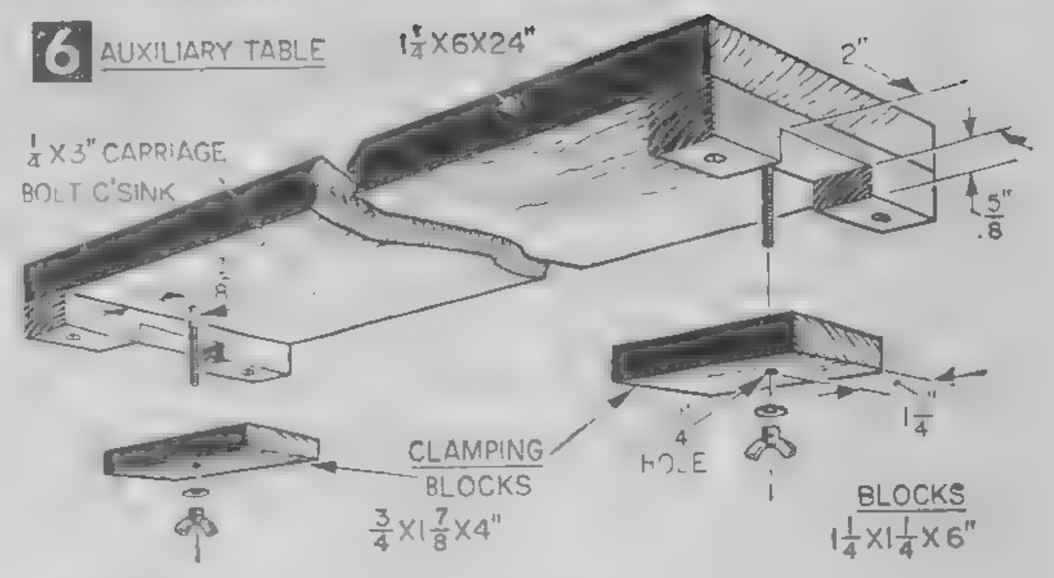
Shaping table, auxiliary table and drill press head are quickly set up with clamping bars and wing nuts.



Adjustable fence-half mounts on slotted hardwood block.



5 FENCE ASSEMBLY



1¼-in. auxiliary table allows shaping of board edges with upper part of a shaping cutter.

in. tempered hardboard to a piece of ½-in. plywood. After the glue has set, trim and square the edges to form a 14 x 20-in. table top (Fig. 2) and cut the miter groove on a bench saw, using a dado cutter. Locate the ends of the fence adjusting slots, drill ¼-in. holes and cut out the rest of the opening with a jig saw. Measure your drill press table to obtain dimensions for spacing the cleats and drilling the clamp. Bore a ⅝-in. dia. hole in the clamp to clear the end of the arbor, and two holes for ⅜-in. carriage bolts. Drill and counterbore the bolt holes in the cleats and fasten them to the table with glue and wood screws. Then, with the table top in place, locate, drill and counterbore the ½-in. hole for the brass bushing.

Make the fence (Fig. 5) from a hard wood, such as maple or oak, glueing all joints and countersinking the screw and bolt holes. Be sure the holes for the carriage bolts line up with the slots in the shaping table. Attach the left half of the fence directly to the base and the right half to the adjustable block. An auxiliary table (Fig. 6) is used to raise the work 1¼ in. above the shaping table, allowing greater variation in cuts

MATERIALS LIST—SHAPING ACCESSORIES FOR DRILL PRESS

Amt. Req.	Size and Description	Use
1	¼ x 15 x 21" tempered hardboard	table top
1	¾ x 15 x 21" plywood	table
2	1¼ x 3 x 14" hardwood (oak, maple, etc.)	cleats
1	1¼ x 3 x 20" hardwood	clamp bar
1	¾ x 3 x 19" hardwood	fence base
2	¾ x 2⅜ x 7" hardwood	fence plates
2	¾ x 3 x 8" hardwood	fence halves
2	¼ x ¼ x 3" hardwood	cleats
1	1 x 1½ x 3½" hardwood	adjusting block
1	1¼ x 6 x 24" hardwood	auxiliary table
2	1¼ x 1¼ x 6" hardwood	cleats
2	¾ x 1⅞ x 4" hardwood	clamping blocks
1	¾" dia. x 6" cold-rolled steel bar	arbor
1	1" dia. x 1¼" brass bar	bushing
2	½-20 hex nuts (one washer)	arbor and bushing lock nuts
2	⅜"-16 x 3¾" carriage bolts, flat washers and hex nuts	
2	¼"-20 x 3" carriage bolts with flat washers and wing nut	
1	¼"-20 x 2½" carriage bolt, washer and wing nut	
2	¼"-20 x 2" carriage bolt, washers and wing nuts	
4	¼"-20 x 1¾" carriage bolts, with washers and wing nuts	
20	#12 x 1¾" wood screws	
5	#10 x 1¼" wood screws	
2	¼" strap iron, to suit drill press column (Fig. 3)	column clamp
2	¼"-20 machine bolts, flat washers and wing nuts	

MATERIALS LIST—ROUTING VISE

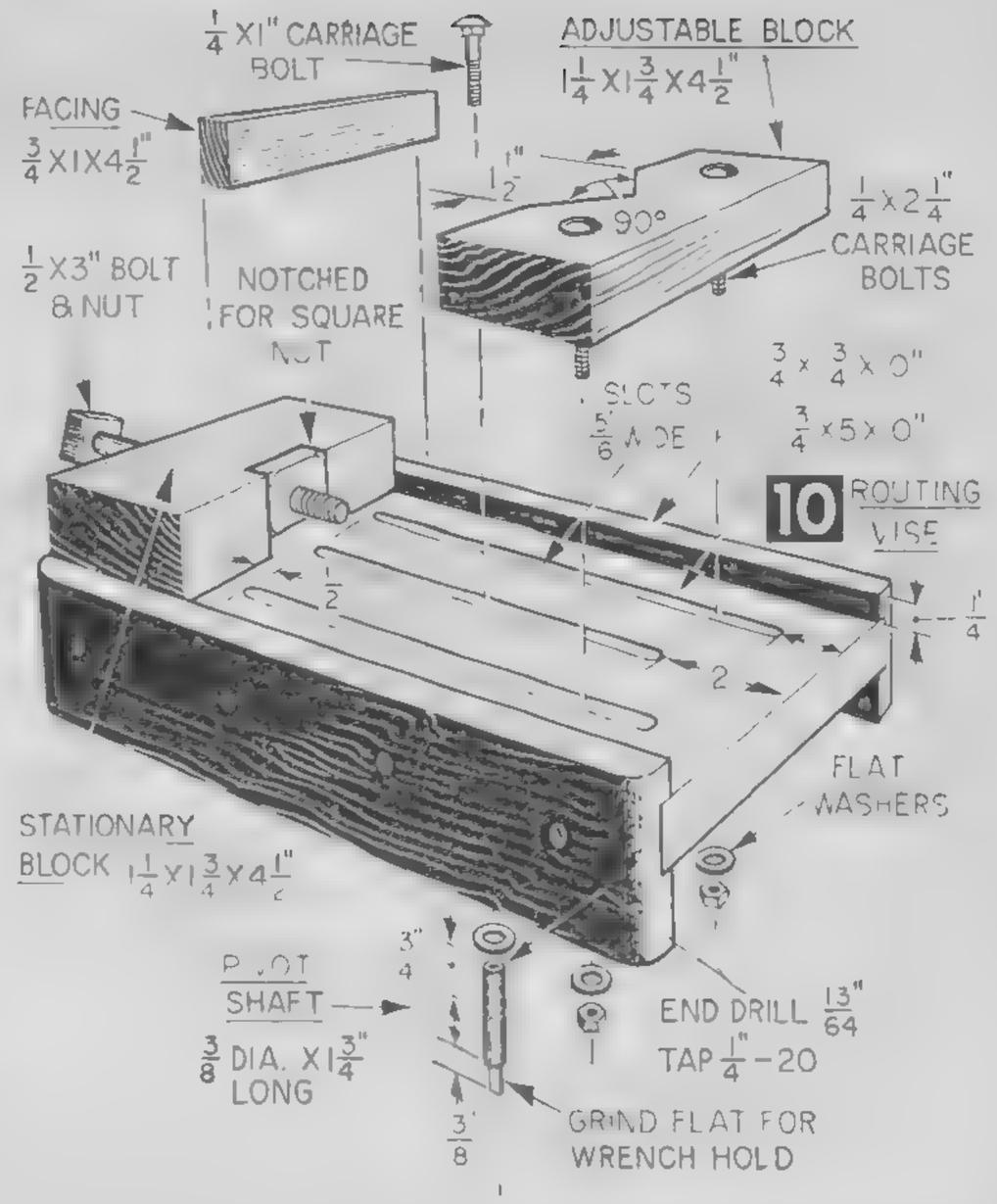
Amt. Req.	Size and Description	Use
1	¾ x 5 x 10" hardwood	vise table
2	¾" x 1¾ x 10" hardwood	table sides
2	1¼ x 1¾ x 4½" hardwood	jaws
1	¾ x 1 x 4½" hardwood	facing
1	½"-13 x 3" machine bolt, and square nut	
2	¼"-20 x 2¼" carriage bolts, flat washers and hex nuts	
1	¼"-20 x 1" carriage bolt and flat washer	
1	⅜" dia. x 1¾" cold-rolled steel bar	pivot shaft
8	#7 x ¾" wood screws	
6	#10 x 1¼" wood screws	

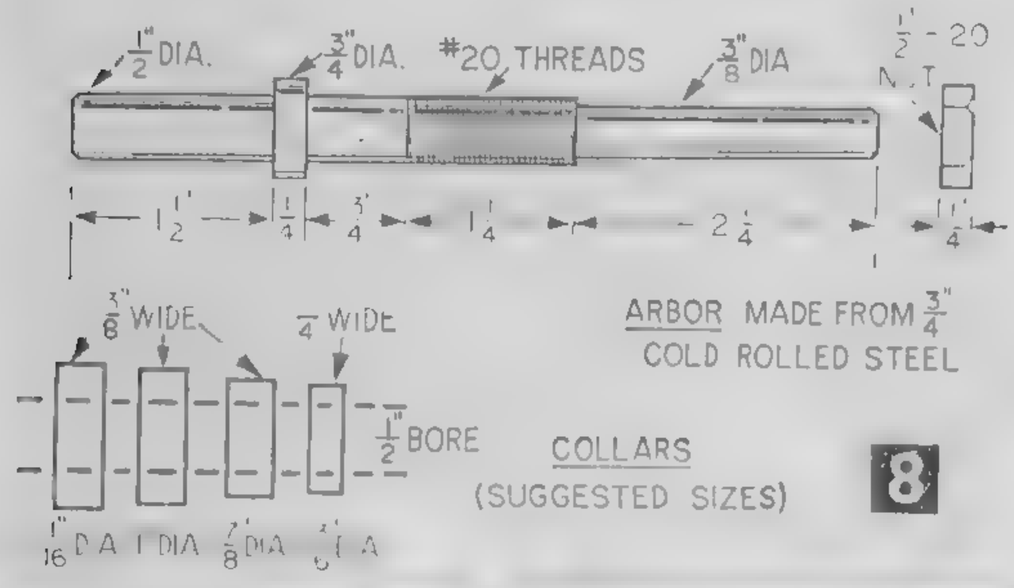
when using shaper cutters. Make this table from hardwood and clamp it to the shaping table (Fig. 3).

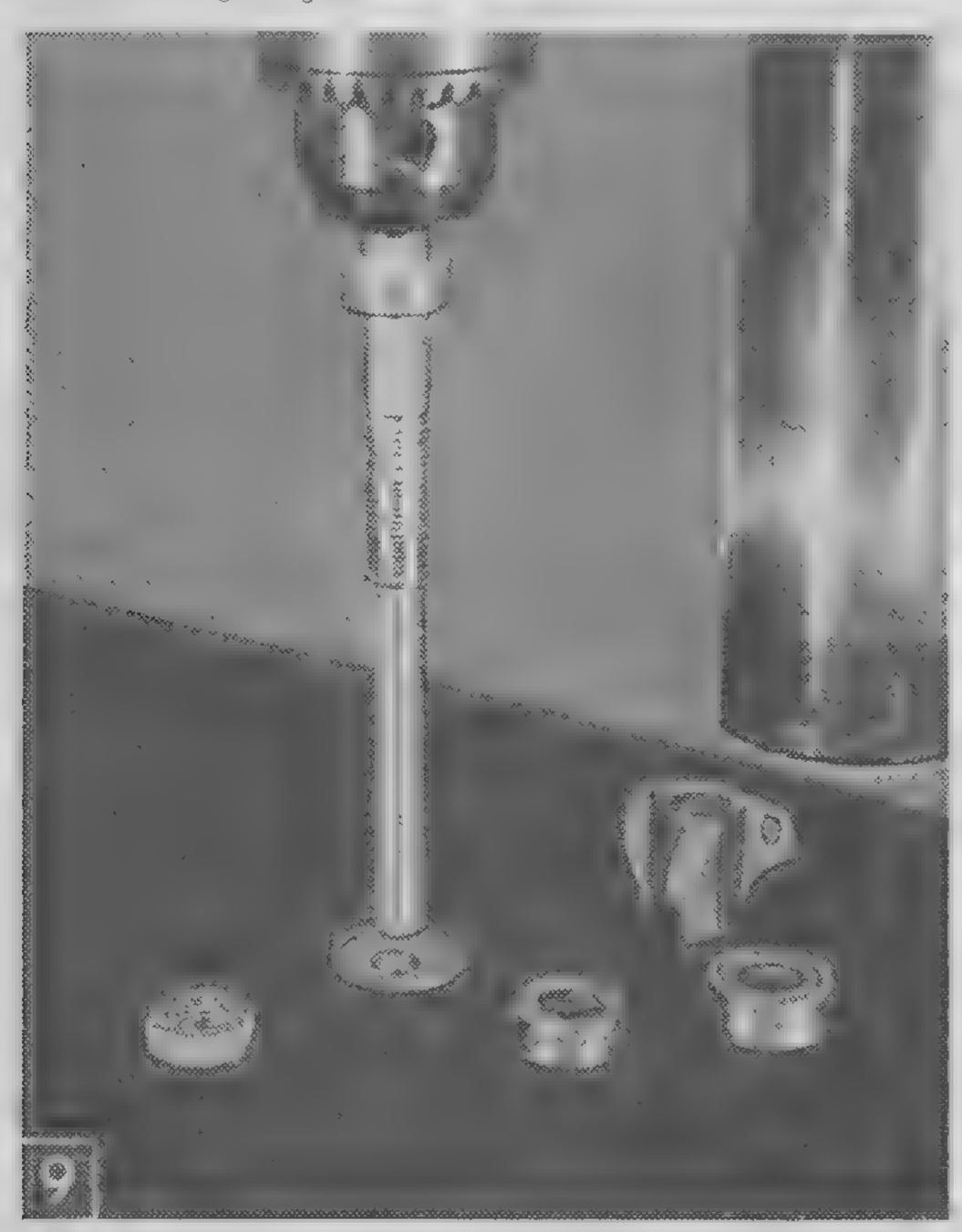
Make the bushing (Fig. 2) by turning and boring from brass stock. Thread the lower end ½-20 and insert it in the shaping table. The bushing should be flush with the table top and extend through the hole in the regular drill press table, where it is held in place with a hex nut and flat washer. Turn the arbor from ¾-in. steel rod (Fig. 8), thread ½-20 and chamfer. Be sure the ⅜-in. dia. is a free running fit in the bushing. Make up or purchase a set of steel collars of the sizes suggested in Fig. 8 to fit the arbor.

Make the column clamp from strap iron and bend to fit your drill press column. With the clamp in place (Fig. 3), the table can be loosened and swung to a new position without disturbing its height from the cutter—a great help when routing or shaping.

A routing vise (Fig. 10) can be added to this equipment. This vise is especially adapted to routing circles and arcs by pivoting on a shaft set in the ⅜-in. shaper table bushing. Assemble the slotted vise table and the table sides with wood screws and glue. Cut a V-shape in the adjustable block and notch the stationary block to hold a ½-in. square nut. Drill this block and insert a ½-in. dia. x 3-in. machine bolt through it and the nut, facing the bolt tip with a ¾-in. x 1-in. strip to protect the work. Drill the facing part way through to keep it in place. Turn the pivot shaft from ⅜-in. steel rod. Drill and tap one end to fit a ¼-20 carriage bolt and file wrench flats on the other end. The upper end of the pivot shaft is positioned in the vise table slots and tightened on the carriage bolt for circular cuts.



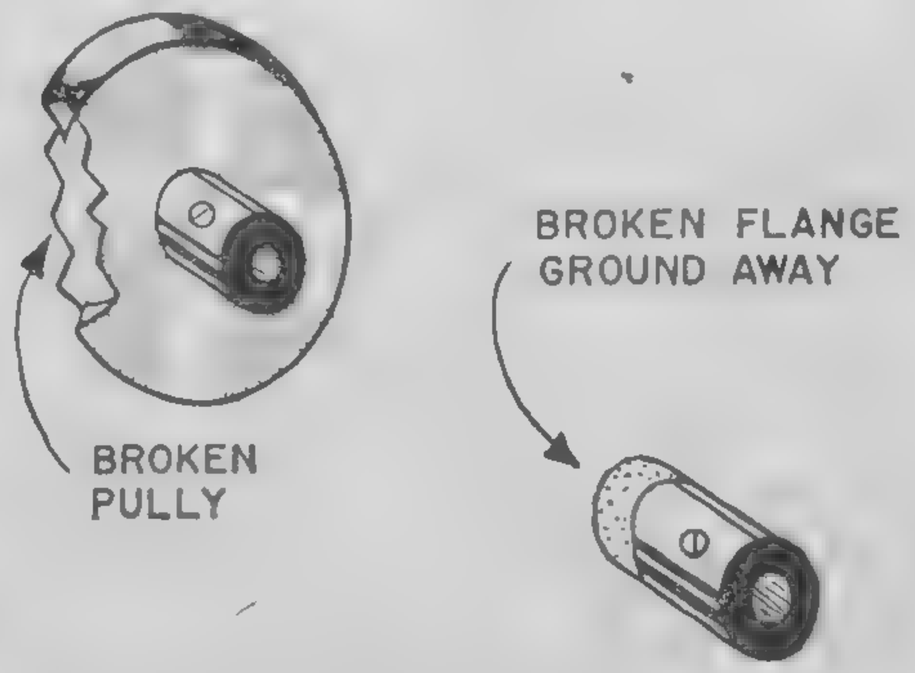




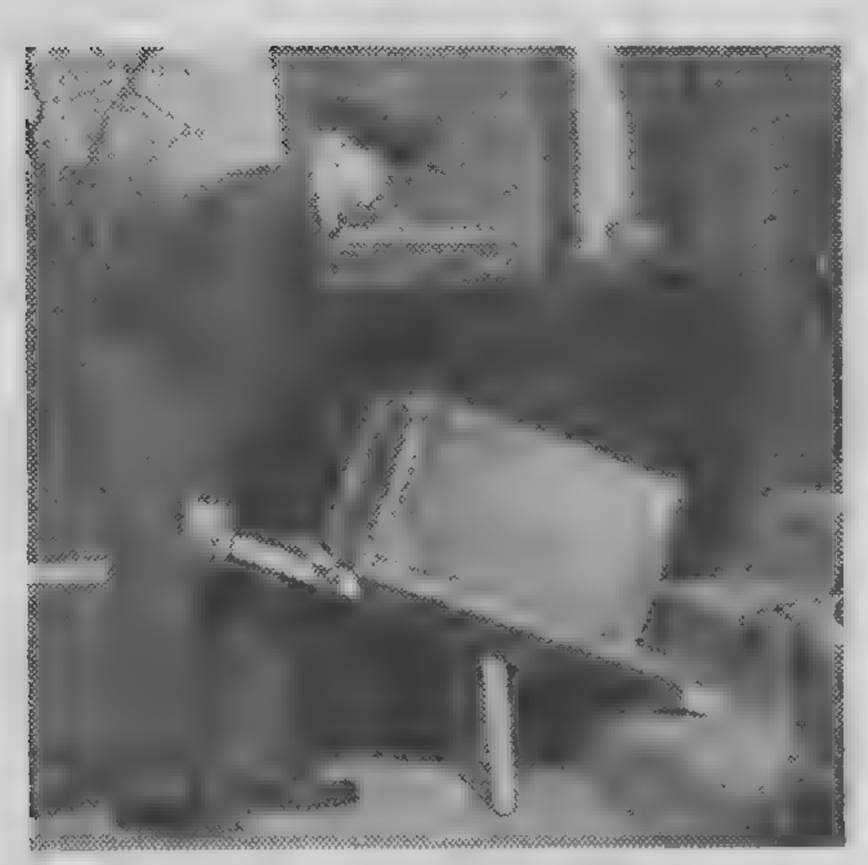
End bushing in shaping table eliminates time-consuming changes in drill spindle by preventing lateral movement of arbor.

Broken Pulley Yields Shaft Collar

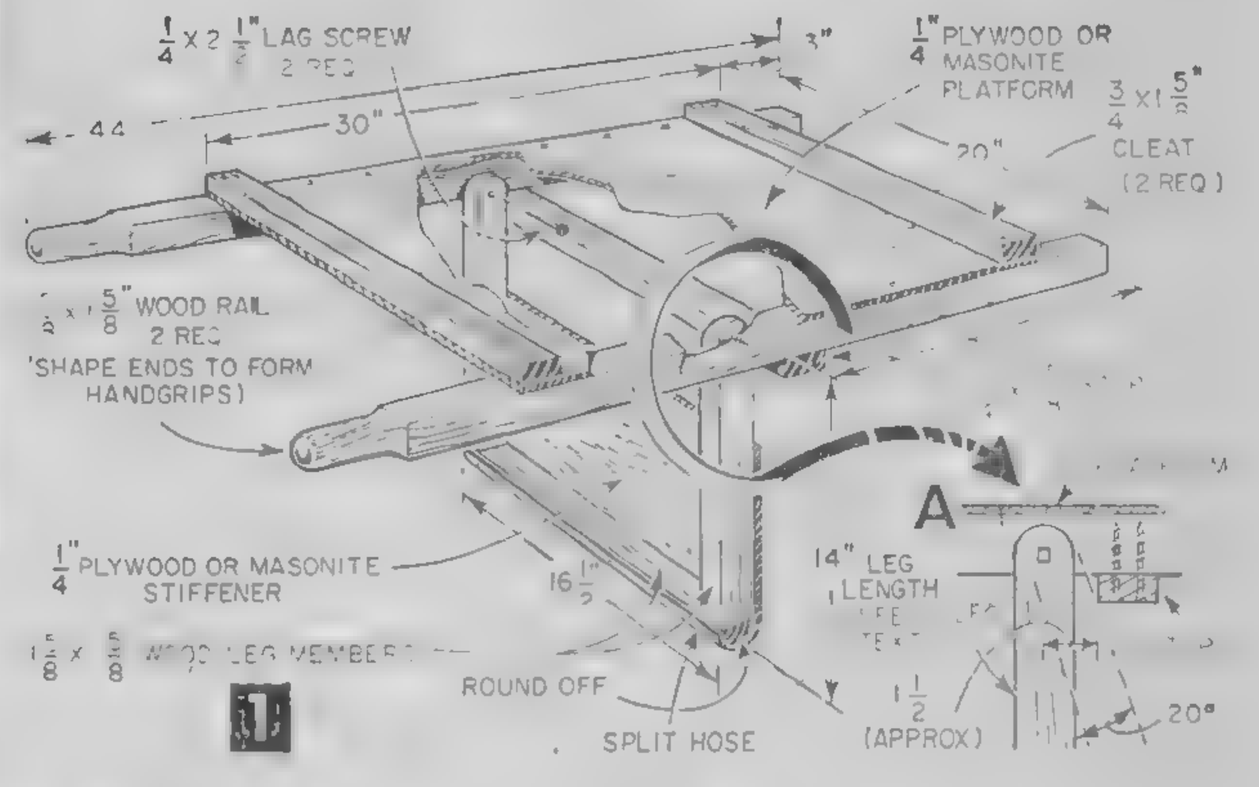
• Don't throw away that smashed or bent belt pulley until you have salvaged its hub for use as a shaft collar. Trim or break away the flange and then grind the collar smooth.



Stair-Climbing Load-Lifter for Heavy Objects



The inventor of the climbing lifter, Carl O. Stanius, jockeys a heavy air-conditioning unit up his front steps with very little effort.



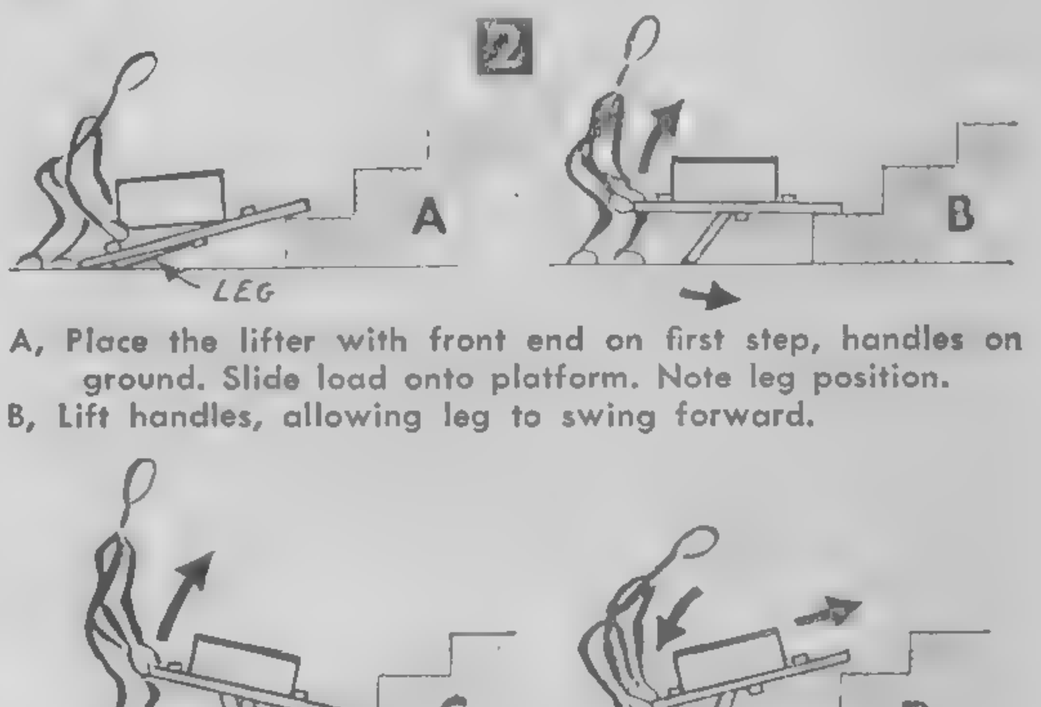
HALFWAY between a wheelbarrow and a teeter-totter, this back-saver puts two-man lugging jobs on a one-man basis. You can make one for a few dollars worth of new materials, and out of odds and ends for nothing.

Make the rails and leg members of 1⅝-in. x 1⅝-in. wood, (see Materials List). The leg length should be a little less than the height of two steps—the 14-in. shown is right for 7¾-in. steps. Drill the leg pivot holes in the rails (Fig. 1), then attach the plywood (or Masonite) platform to the rails with #8 x 1-in. *fh* screws. Use #8 x 1½-in. *fh* screws to secure the cleats through the platform to the rails, and more 1-in. screws to secure the platform to the cleats, from underneath. Round off the bottom leg member and the upper ends of the leg uprights (Fig. 1), then nail these parts together. Attach the leg stiffener to the leg frame with #8 x 1-in. *fh* screws. Tack a piece of 1-in. hose, split, to the bottom of the leg, for a non-skid tread. Pivot the leg to the rails with 2½-in. lag screws, then install a ¾ x 1⅝-in. stop on the underside of the rails with four 1½-in. screws, placing it so as to limit the forward swing of the leg to about 20° (Fig. 1A). This will prevent the lifter from folding backwards when in use. Now whittle the handgrips to shape and give the whole outfit a coat of paint, to finish the job.

Follow the step-by-step drawing, Fig. 2, to see how the walking lifter works.—Carl O. Stanius.

MATERIALS LIST—STAIR-CLIMBING LOAD-LIFTER

Amt. Req.	Size and Description	Use
12′	1⅝ x 1⅝" softwood	rails, leg members
5′	¾ x 1⅝" softwood	cleats, stop
1	20 x 30", ¼" plywood or Masonite	platform
1	8 x 17", ¼" plywood or Masonite	leg stiffener
1	1" rubber hose, 16½" long	leg
12	#8 *fh* woodscrews, 1½" long	cleats, stop
4	3" common nails	leg
24	# 8 *fh* woodscrews, 1" long	platform, stiffener
12	#6 tacks	leg
	paint	



A, Place the lifter with front end on first step, handles on ground. Slide load onto platform. Note leg position.

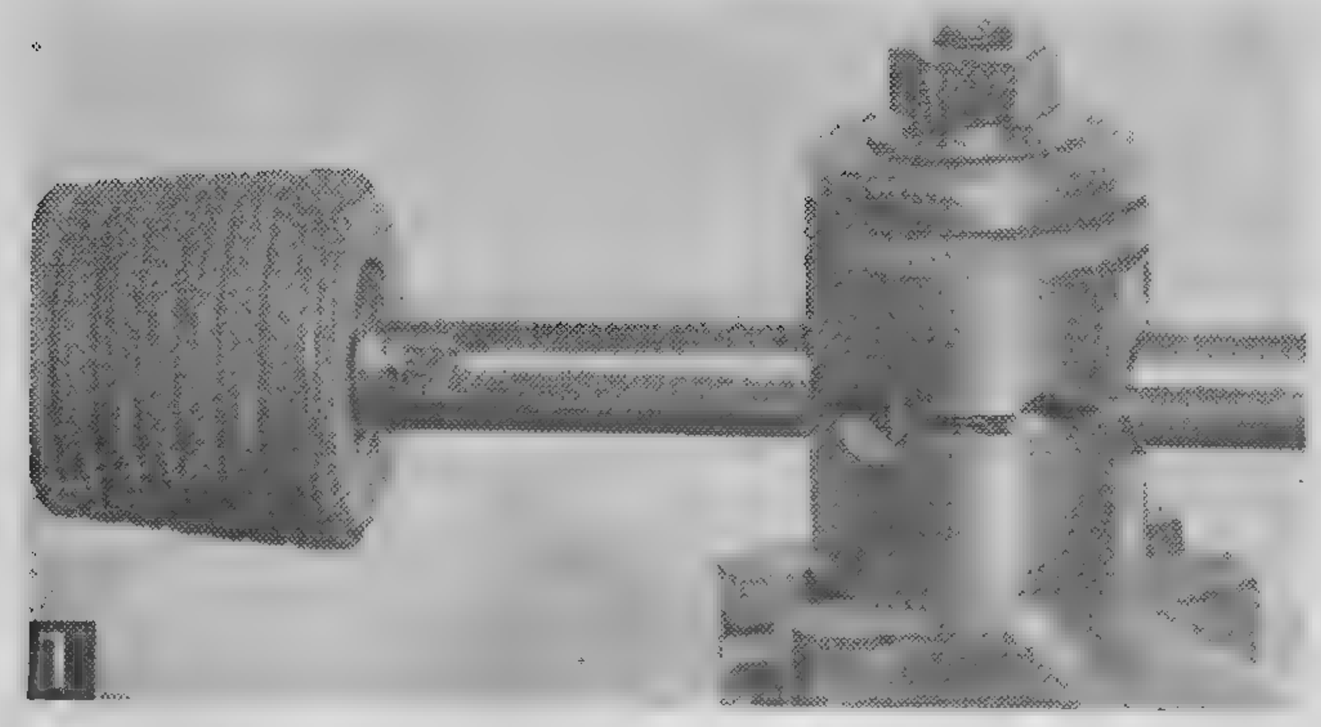
B, Lift handles, allowing leg to swing forward.

C, Continue lift until leg swings all the way forward against stop.

D, Press down on handes, and ease front of lifter up to second step.

E, Lift again, allowing leg to swing forward and up to first step.

F, Continue lift until leg is all the way forward, on the first step. This corresponds to position 2C. From here on, repeat the sequence to continue walking the load up the steps.



Bar stock is set up in four-jawed chuck while boring clearance hole in plug and bar support holes in body.

Boring Bar Holder

Provides chatterproof operation for three sizes of boring tools

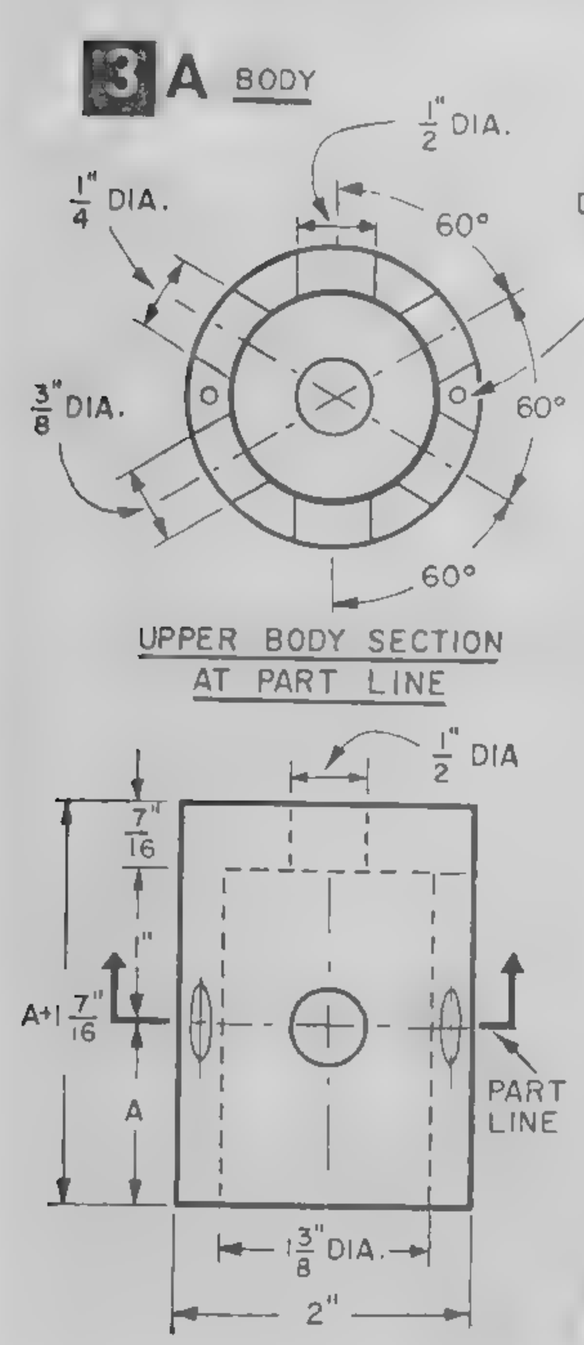
SINCE the accuracy of a boring operation depends on the boring bar holder, it must be sturdy enough to be chatterproof and accommodate as many of your boring tools as possible with the same rigidity.

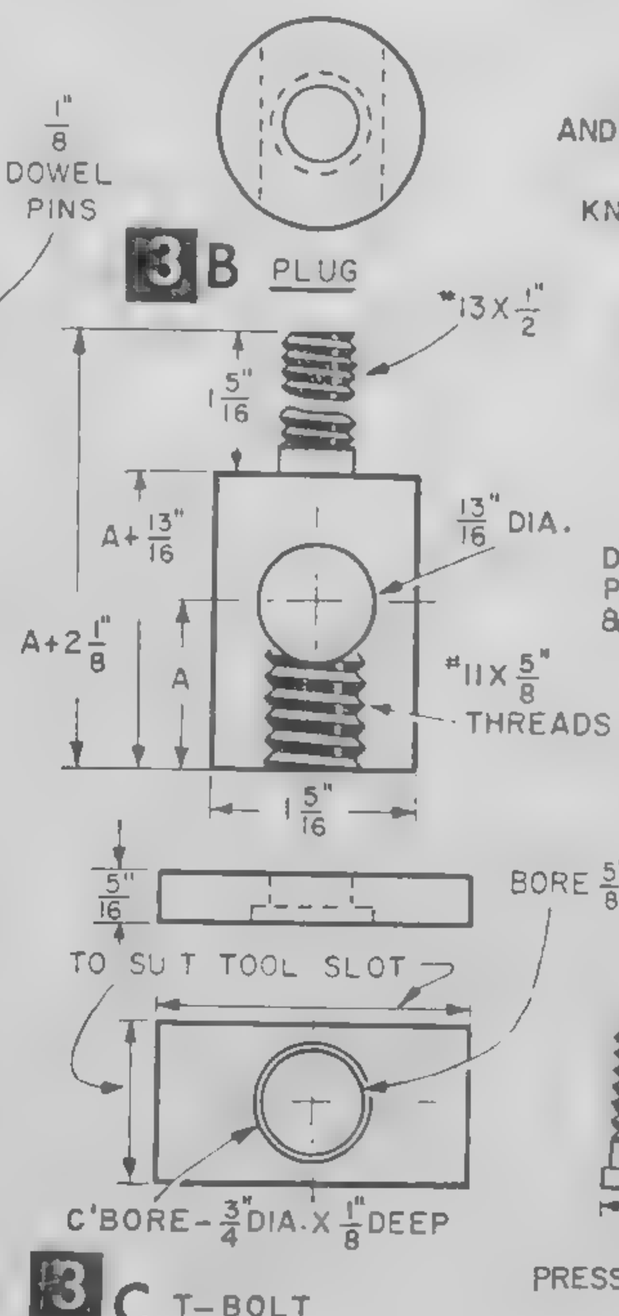
The tool-post mounted holder shown in Fig. 1 handles ¼, ⅜, and ½-in. dia. bars or forged boring tools. These sizes, however, can be changed to accept your boring tools by simply changing the sizes of the bar supporting holes in the holder.

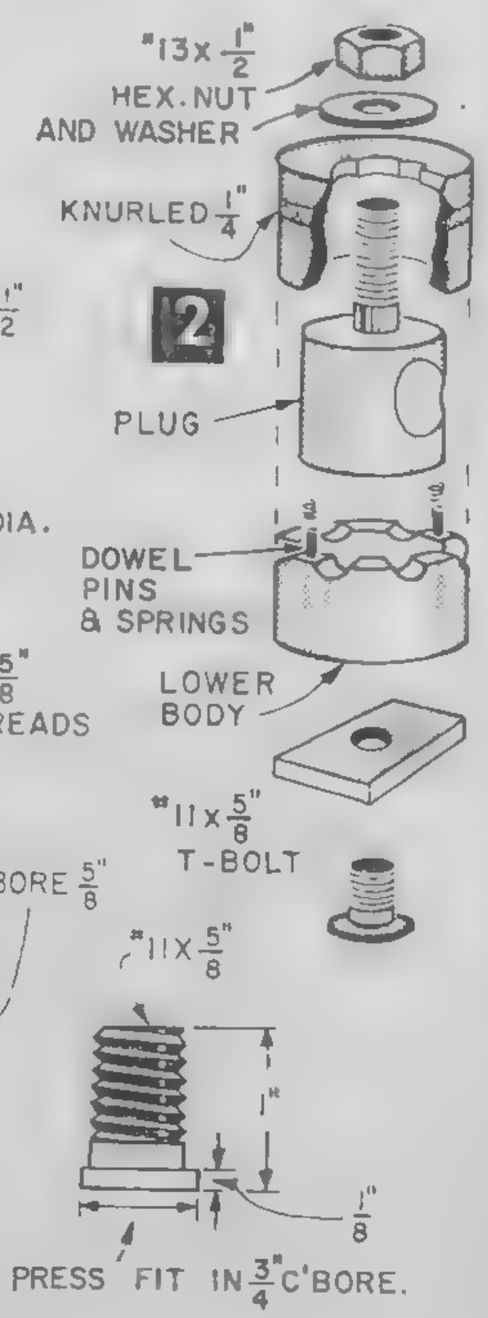
To make the holder to suit your lathe, first determine the vertical distance from the top of the tool post slide to the lathe center and use it as dimension "A" in Figs. 3A and B. Other dimensions given are based on dimension "A," plus a given measurement.

Make the body of the holder from a piece of 2-in. cold-rolled steel bar. Mount the bar in a chuck and drill a ½-in. hole completely through the length of the piece. Bore out one end to 1⅜-in. dia., 1 in. deeper than dimension "A." While the body is still in the chuck, scribe the center lines for the three boring bar holes and lay out the centers, spacing them equally, 60° apart. Mount the body in a four-jawed chuck (Fig. 4) and drill and bore ½, ⅜ and ¼-in. holes, or other sizes to suit your boring bars. Rechuck the piece and part the body exactly on the center line of the holes. Trim the mating surfaces to obtain a length 1/16 in. less than dimension "A" on the lower half and 1⅜ in. on the upper half. Two ⅛-in. dowel pins are fitted between the halves of the body. Secure these in the lower half by making punch marks next to the pins. The upper half should be a free sliding fit over the pins.

Turn the 1 5/16-in. dia. on the plug, rechuck it and bore the 13/16-in. hole (Fig. 4). Now, turn the stem to size and cut #13 x ½-in. threads on it. Reverse the part in the chuck and drill a 17/32-in. hole through the lower part and thread the hole #11 x ⅝ in.







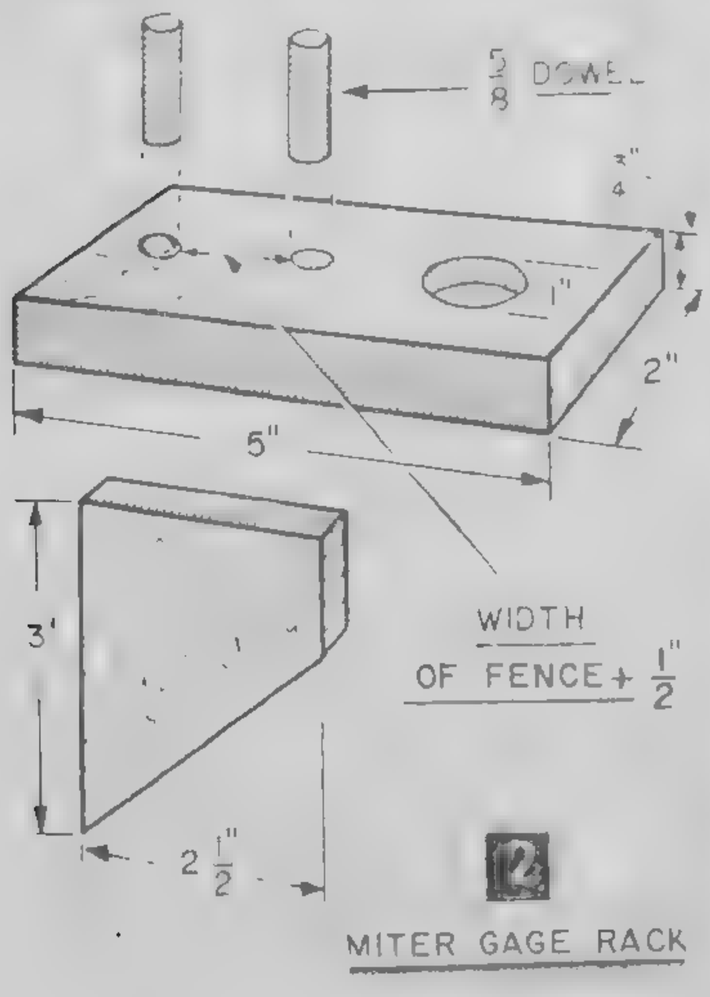
The T bolt (Fig. 3C) is made from a flat piece of 5/16-in. cold-rolled steel, drilled and bored 5/8 in. through its center and counterbored 3/4 in. dia. x 1/8 in. deep. Turn down the head of a #11 x 5/8-in. machine bolt to be a press fit in the 3/4-in. counterbore. Press it into the plate and finish the head flush with the surface.

Assemble the holder as in Fig. 2, using a #13 x 1/2-in. hex nut and a flat washer. Place two 1/4-in. dia. x 1/4-in. coil springs on the dowel pins to free the upper half of the body when changing boring bars. Finally, knurl a 1/4-in. band near the upper edge of the body to provide a grip when mounting the holder to the tool post slide and polish the complete assembly with 7-0 emery paper.—Joel B. Long.

Rip Fence and Miter Gage Rack

YOU need both the rip fence and miter gage on your saw table. But, since you rarely use both of them at once, one or the other is usually in the way. To prevent this inconvenience, and possible damage to your equipment, why not build a rack (Fig. 1) to store your miter gage and fence out of the way, yet always within reach?

Drill 1/2-in. dowel holes in two 6-in. lengths of 3/4-in. scrap lumber, spacing the dowels to suit the width of the fence (Fig. 2). Bore a hole large enough to fit the bar of your miter gage in one of the pieces and mount both of them to wood angle brackets with screws and glue. Then drill the body of your saw table and mount the brackets with wood screws from inside of the body. Glue or screw additional blocks in place to make the brackets fit the contour of the saw table body. — P. K. Snook.

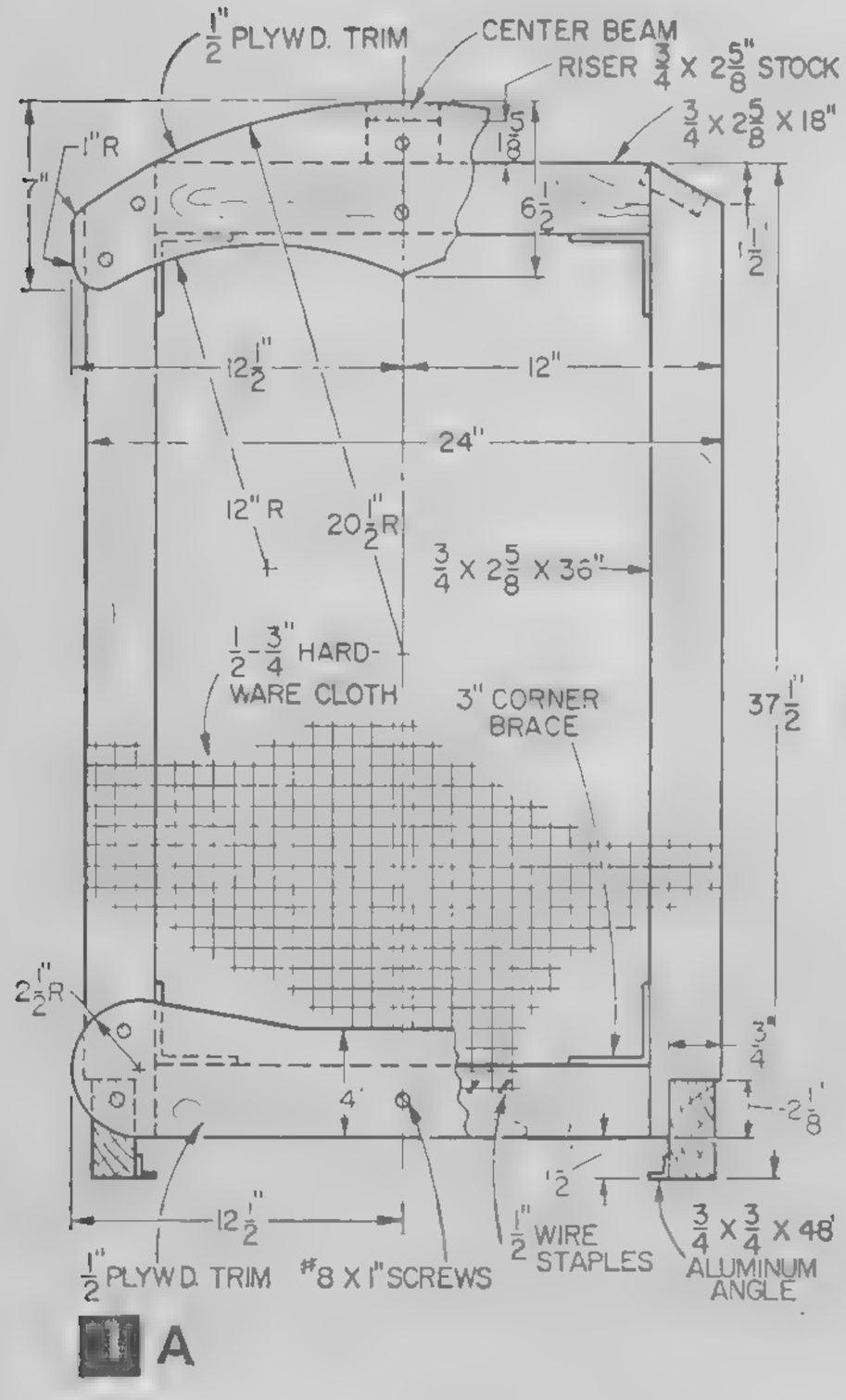


MITER GAGE RACK

Portable Parakeet Aviary

By HI SIBLEY

Whether you're a bird fancier and breeder or just like to have a few budgies as pets, you (and the birds) will appreciate this airy indoor-outdoor aviary.



A

YOU can provide plenty of fresh air and sunshine for your talkative pets with this aviary that has a lift-off roof to give protection from direct sunlight and rain and a rolling base that allows it to be moved around as simply as a tea-cart.

You can use a variety of different materials to make your aviary. So be sure to check your scrap bin before making any purchases.

Cut the bottom rails (Fig. 2) to length, and then make the two end frames (Fig. 1A). Bevel the upper ends of the corner uprights, and cut the notches for the rails in their lower ends. Notice that the rails extend 1½ in. below the uprights to clear the aluminum cleaning pan.

Next, cut the top and bottom crossmembers for the end frames and fasten these to the uprights with inside corner brackets. Attach the end frames to the rails with waterproof glue and 10-in. shelf brackets.

Cut the center-beam risers (Fig. 1A) to length, and attach these with slanted nails to the top of each frame. Then cut the center beam and two side beams and attach these with glue and nails. Butt the side beams between the frames, and nail the center beam to the top of the risers.

Cut and bevel two uprights for the door framing (Fig. 2B), and then assemble these with a pair of separators. When this assembly is attached to the aviary frame, hang a ½-in.

plywood door on cabinet hinges between these separators and install a draw-bolt latch.

Now cover the frame with 48-in. widths of ¾-in. mesh hardware cloth (or aviary cloth if it is available), using ½-in. screening staples. With the hardware cloth in place, fasten the ½-in. plywood trim pieces on each end frame with flat or oval-head woodscrews and finishing washers. Attach a pair of door pulls or sash lifts to each end of the aviary to make it easy to lift on and off the base.

Make the roof from a single sheet of 22 ga. aluminum or galvanized iron according to the dimensions in Fig. 2. Install the ¾-in. lumber gable ends far enough apart lengthwise to straddle the aviary. Use ordinary door hooks to guard against unexpected gusts of wind and attach a door pull at each gable end.

Make the cleaning pan from the same material as the roof. Cut the corners and bend the metal as in Fig. 2A, and then use sheet metal screws to hold the corners in place. Another door-pull here will make it easy to draw the pan out.

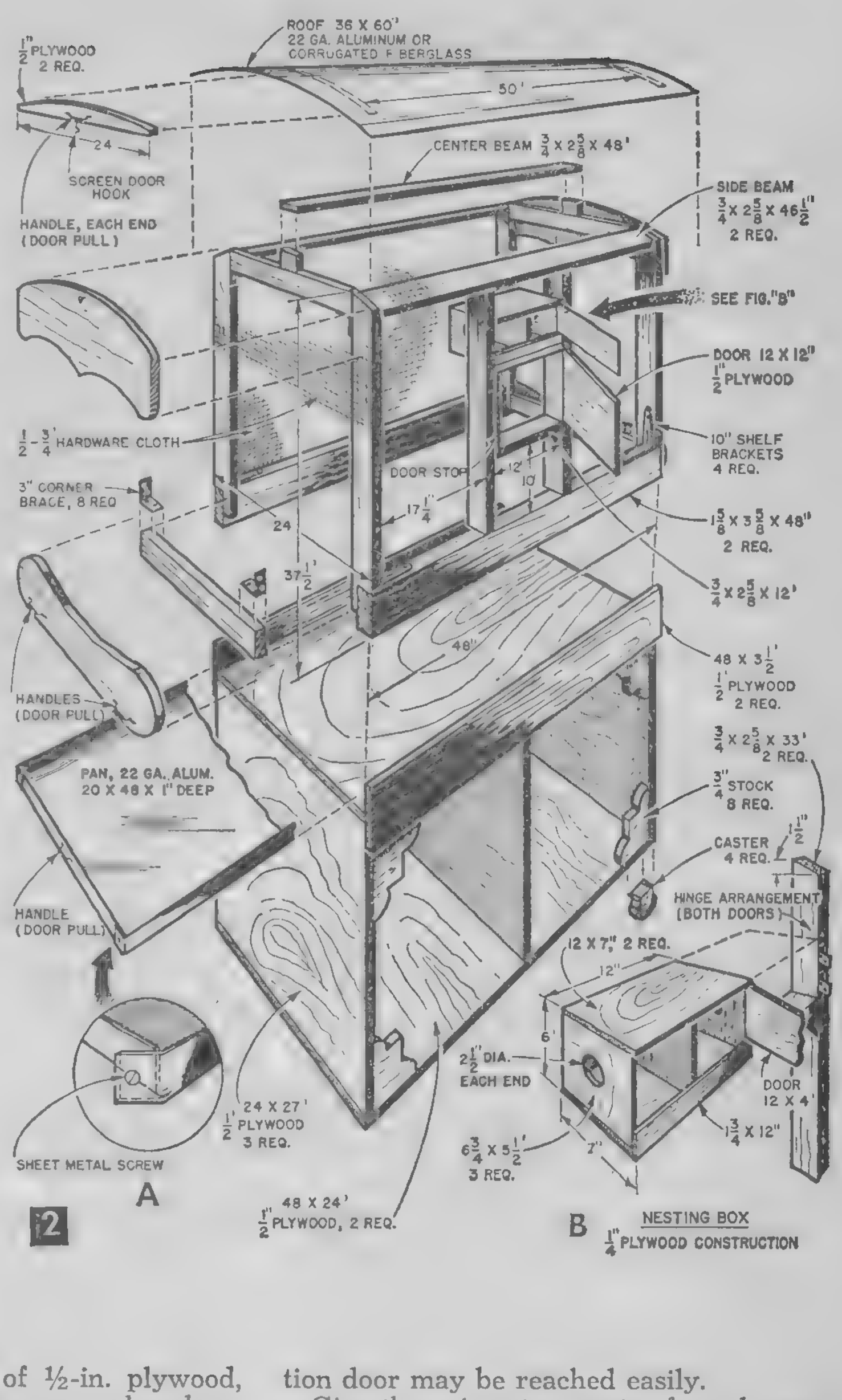


Fig. 2

Make the rolling base of ½-in. plywood, with the ends left open for removal and replacement of the cleaning pan. Cut the plywood panels to size and assemble them with waterproof glue and 1-in. woodscrews. Bandsaw the decorative corner braces to shape from ¾-in. lumber and attach them in the same way. Then install four heavy-duty, office-type furniture casters in the base.

The nesting box is made from ¼-in. plywood with a hinged observation panel in one side. Make 2½-in. entranceways in the end panels with a jigsaw and assemble the nesting box with glue and brads. Then mount it on the door frame with screws so its observation door may be reached easily.

Give the aviary two coats of porch enamel, or stain it and finish it with spar varnish. Finally install the necessary equipment, such as a feeding hopper, a water tray for bathing, and ½-in. dowel perches to make your aviary a parakeet's paradise. Cut the perches to be 1-2 in. longer than the width of the aviary, slot each end, and prop them between the wire mesh on each side.

Be sure to have enough perches for all the birds up under the roof to give shelter from rain and hot sun. When necessary, pin windbreaks cut from plastic curtain material to one or two sides of the aviary.

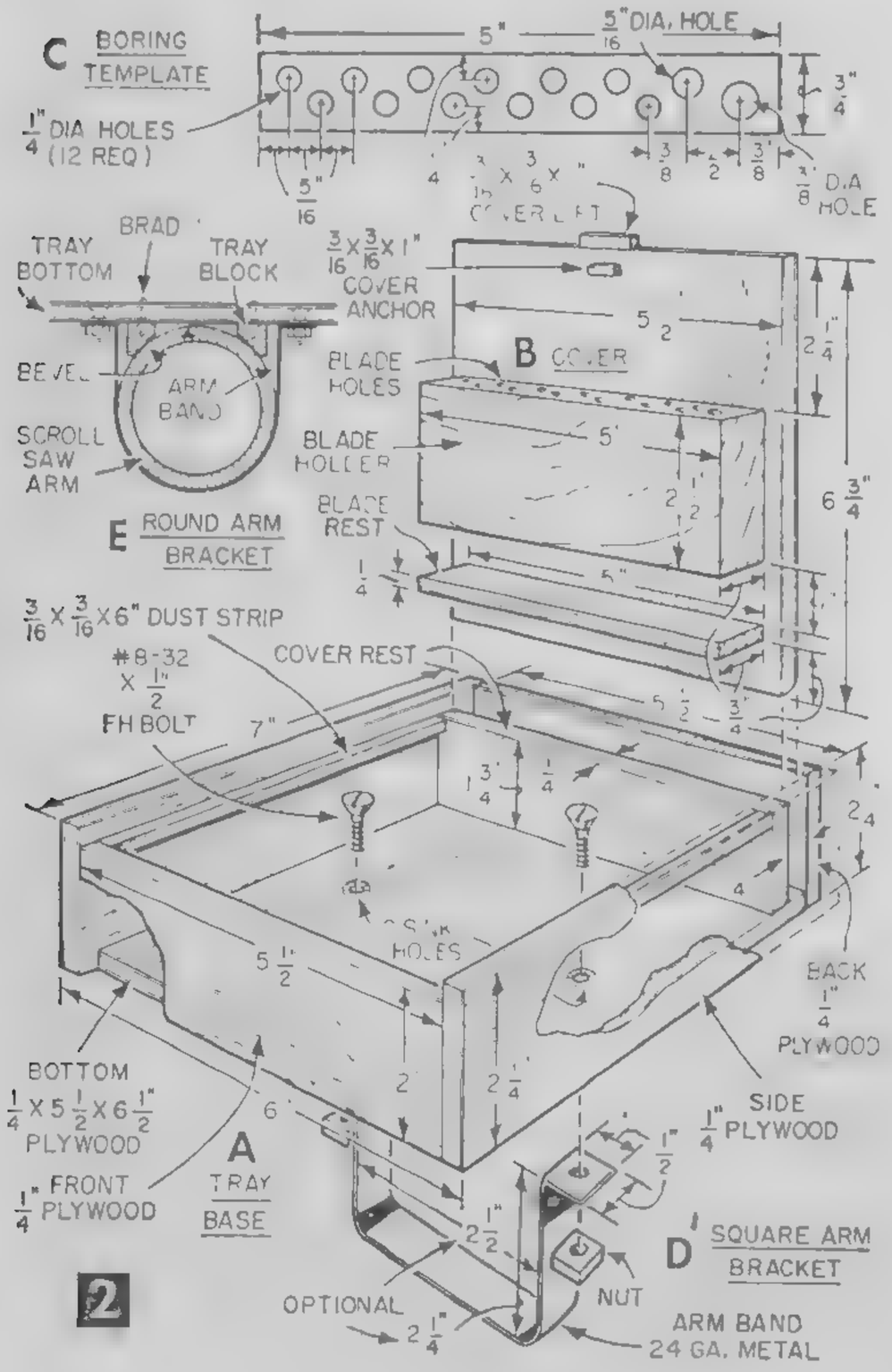
Scroll Saw Accessory Tray

Accessories never go astray with this storage tray attached to the arm of your scroll saw. Blades can be segregated according to type, making selection easy.

HERE'S an easy way to keep those loose parts for your scroll saw from disappearing when you want them. The efficient little accessory tray strapped to the saw arm in Fig. 1 holds 14 different blades in a stand-up cover, with room below for files, sanders, chucks, guides and wrenches.

If you have any plywood and pine scrap at all, there's probably enough to cut out all the pieces indicated in Fig. 2. We designed this model for 5-in. blades, but for the 6-in. size, merely make the cover, bottom, sides and dust strips an inch longer. Sand all parts smooth before assembling, first with 100-grit paper, then 220-grit. Use glue and thin brads at all joints.

After attaching sides to front and back as in Fig. 2A, add in order the bottom, cover rest and dust strips. Make the cover next as in Fig. 2B and add the blade rest, lift and anchor. Note that the rear, upper edge of cover is rounded. This eliminates the need for hinges to open the cover—you can remove it entirely from the tray for close examination when choosing the blade you want.



2

Prepare a paper template as in Fig. 2C and rubber cement it to top side of the blade holder. Bore holes indicated through the holder, then peel off paper. This will accommodate blades from fine to the ¼-in. saber types.

To mount the tray on your machine, make the bracket as in Fig. 2D if the overarm is square; as in Fig. 2E if it's round. Use small wood blocks with the latter to keep tray from shifting sideways. Countersunk bolts anchor tray to arm as in Figs. 2A and E.

For finishing, apply interior primer. When dry, sand smooth with 220-grit paper and fill brad holes with putty. After putty has hardened, you can sand it flush with surfaces, dust thoroughly and apply two coats of interior enamel to match the finish on your machine.—FRANK HEGEMEYER.

MATERIALS LIST—SCROLL SAW TRAY

No. Req.	Size and Description
1 pc.	¼ x 12 x 15" plywood (front, back, sides, bottom, cover rest, cover)
1 pc.	¾ x 2½ x 5" pine (blade holder)
1 pc.	¼ x ¾ x 5" pine (blade rest)
2 pcs.	⅜ x ⅜ x 2" pine (blocks for round arm bracket only)
1 pc.	3/16 x 3/16 x 18" pine (dust strips, cover lift and anchor)
1 pc.	½ x 8" #24-gage metal (bracket)
2	#8–32 x ½" *fh* bolts, with nuts (tray fasteners)
Misc.	3 doz. #20 x ¾" brads, 1 doz. #20 x ⅜" brads, 220- and 100-grit garnet paper, rubber cement and small containers of liquid glue, wood putty, interior enamel and primer.

Aero-Age Skate Sail

If your blood zings when you go fast, this up-to-the-minute people-pusher is for you

Coming into the wind, preparatory to going on the starboard tack.

By WILLIAM D. JACKSON

YOU can zip over the ice as fast as 60 *mph* when the wind really blows, or glide along more sedately in a zephyr, even though the air-foil shaped surface of this sail is only half the area of the old-fashioned fabric skate sail. With $5 and a few hours time, you can build it.

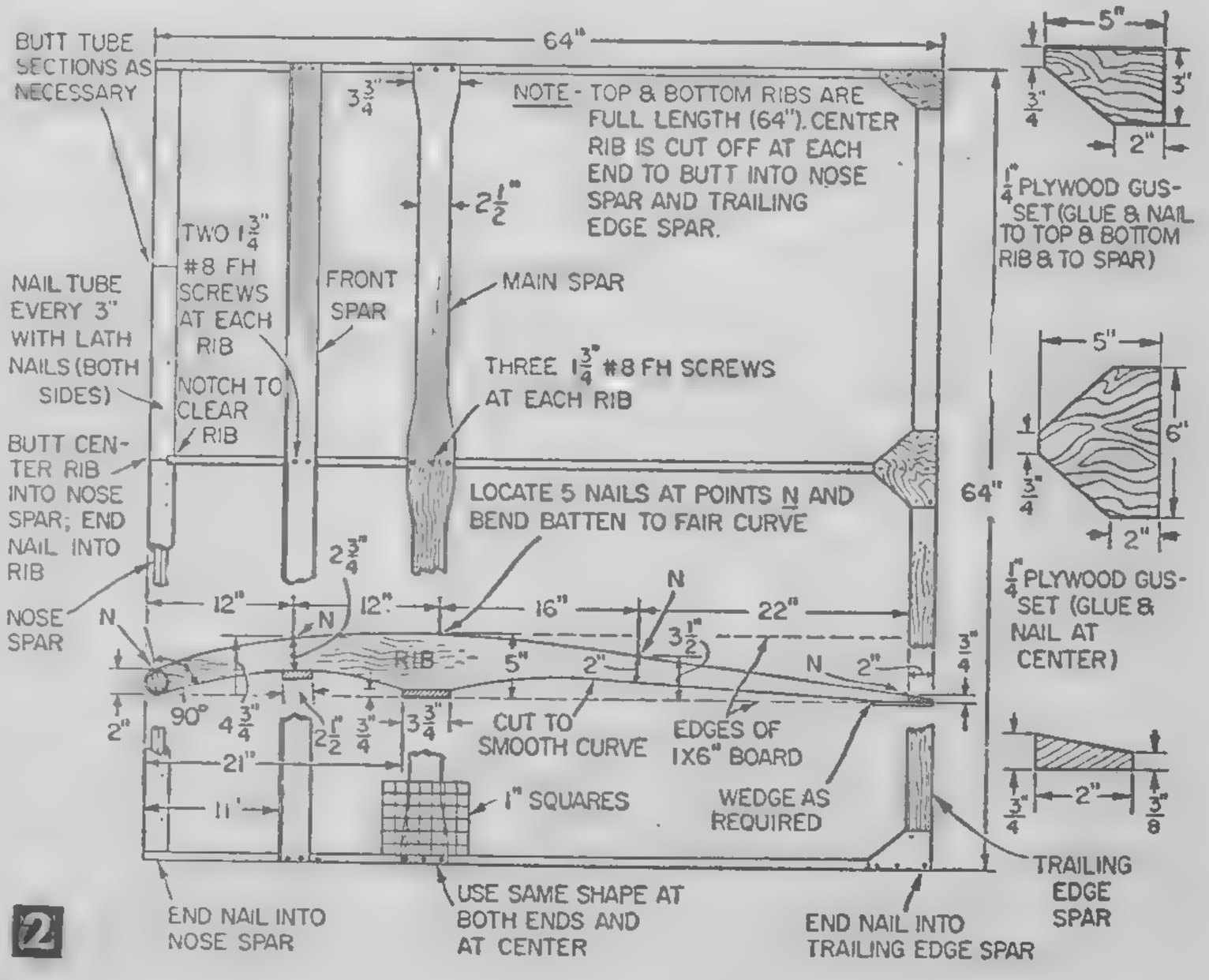
Make the Ribs First. Lay out one rib on a ¾ x 5⅝-in. board, driving 2-in. nails part way into the board at the points N (Fig. 2). Bend a ¾ x ¾-in. wooden batten around the nails and mark the curve line inside the bend. This is the outer rib surface.

Draw a 1-in. radius semi-circle at the leading end of the rib to form the rounded nose. Note the 4-in. wide flat place for attachment of the main spar. Draw a smooth curve, free hand, from this flat to the ends of the rib, observing the widths given at the 2nd and 4th N points, to produce a graceful taper leading out to each end. Cut the rib out on a band saw, or coping saw, taking care not to split off the spar-flat or the rib ends.

Smooth the rib to its final shape with a spokeshave and medium grit sandpaper, then use this rib as a pattern to lay out the remaining two ribs. You will find that some lumber can be saved by overlapping the trailing ends of the ribs in the layout. Do not permit knots, except small sound ones, to be included in the ribs.

Note that the top and bottom ribs are to be made full length, 64 in. The center rib is shortened 1¾-in. at the trailing end, and about 1¼-in. at the leading end, where it abuts the trailing and nose spars. The nose cut is angled so as to be at 90° to the rib edges. Cut out and finish the top and bottom ribs, leaving them full length.

Make the Nose Spar (Fig. 2) from ¾-in. stock and just wide enough to slide into the



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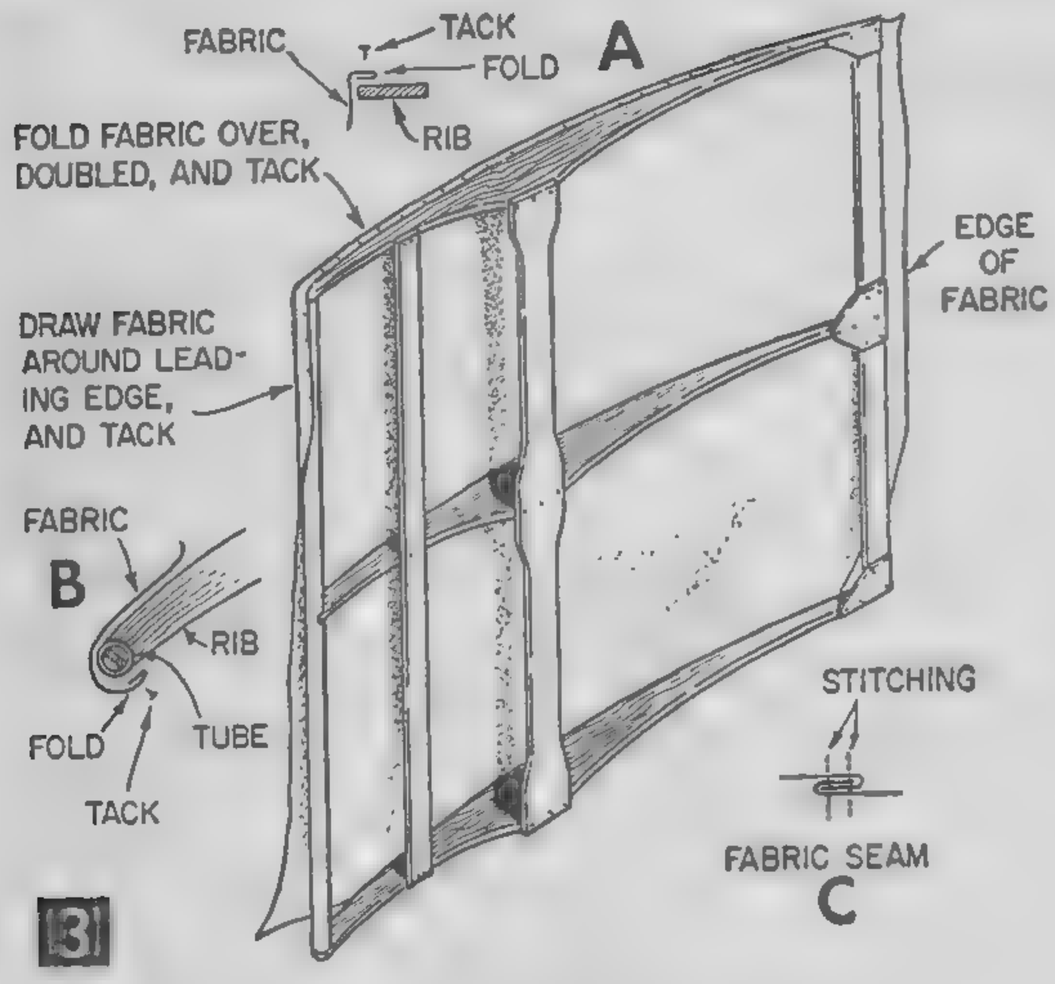
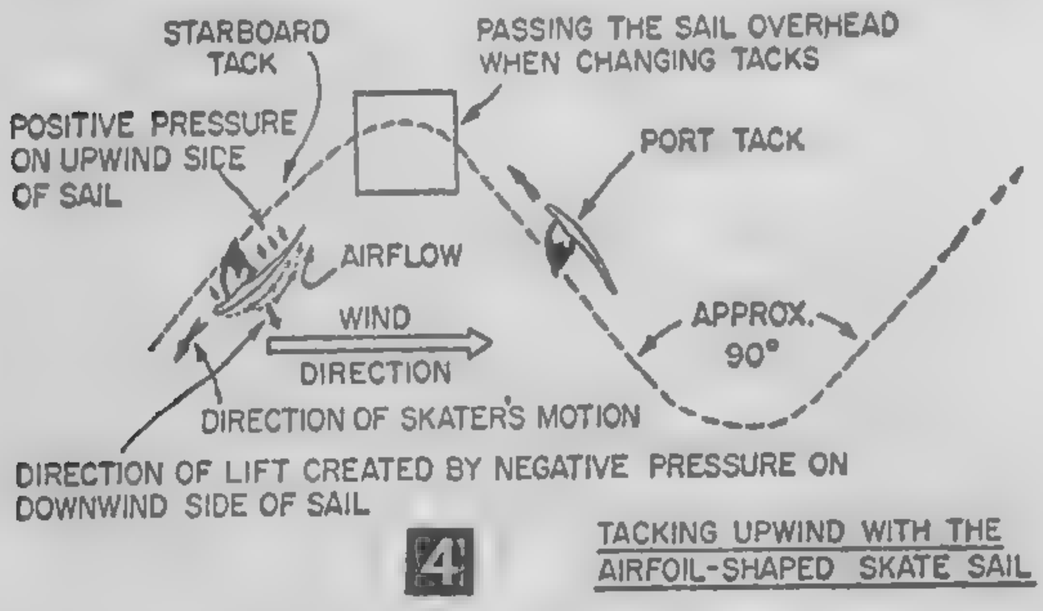


3

cardboard mailing tubes selected for the leading edge. Attach the center rib to the center of the nose spar with waterproof glue and three 1½-in. galv. siding nails. Note that the nose spar (Fig. 2) fits *between* the outer ribs; therefore make this spar 1½-in. shorter than the main and front spars.

Then slip the mailing tubes over the nose spar, notching the two innermost tube pieces to fit around the center rib (Fig. 2). Slip the outer tube pieces into position, and cut them off flush with the ends of the nose spar. Fasten the tubes to this spar with lath nails, driven at 4 in. intervals into *both* edges of the spar.

Also make the front, main and trailing-edge spars out of ¾-in. stock. Shape the main spar as in Fig. 2 with a draw-knife or bandsaw, and round the edges to provide a comfortable hand-grip. Then rip the front spar to width, and round its edges. Attach the main and front spars to the three ribs with 1¾-in. *fh* screws, using waterproof glue at all



4 TACKING UPWIND WITH THE AIRFOIL-SHAPED SKATE SAIL

joints. Taper the trailing-edge spar to ⅜-in. at one edge (Fig. 2) and cut it the same length as the nose spar. End-nail at the ends of the ribs into the nose and trailing-edge spars with 1½-in. galv. siding nails, gluing the joints as before. Add ¼-in plywood gussets to the trailing-edge spar joints (Fig. 2), attaching them with glue and ¾-in. galv. nails. Fit slender wooden wedges between the rib ends and the gussets to provide a flat landing for the gussets.

Cover the Frame with 3½- or 4-oz. muslin, (Fig. 3). If you cannot get cloth wide enough, sew two narrower widths together using the seam construction shown in Fig. 3C.

Attach the fabric to the frame with #4 carpet tacks, (or the wire staples used by builders for fastening house insulation in position). Space the tacks or staples 1 in. apart, starting along the inner surface of the leading edge,

MATERIALS LIST—SKATE SAIL

Amt. Req.	Description	Use
1	¾ x 5⅝" x 16' long pine, spruce or fir	ribs
2	¾ x 1⅝" x 62½" long pine, spruce or fir	trailing-edge spar and nose spar
1	¾ x 3⅝ x 64" long pine, spruce or fir	main spar
1	¾ x 3⅝" x 64" long pine, spruce or fir	front spar
1	5 x 12" x ¼" thick plywood	gussets
4 sq.yds.	3½ or 4 oz. muslin (36" or 72" width, see text)	covering
6 ft.	½" wide dressmakers binding tape	covering
64"	2" dia. cardboard mailing tubes	leading edge
2 qts.	airplane dope, obtainable at most lightplane hangars	covering
15	1¾" #8 *fh* screws	fastenings
10	1½" galv. siding nails	fastenings
2 oz.	¾" galv. nails	fastenings
2 oz.	lath nails	fastenings
6 oz.	#4 carpet tacks	covering
4 oz.	Weldwood glue (or similar waterproof glue)	joints

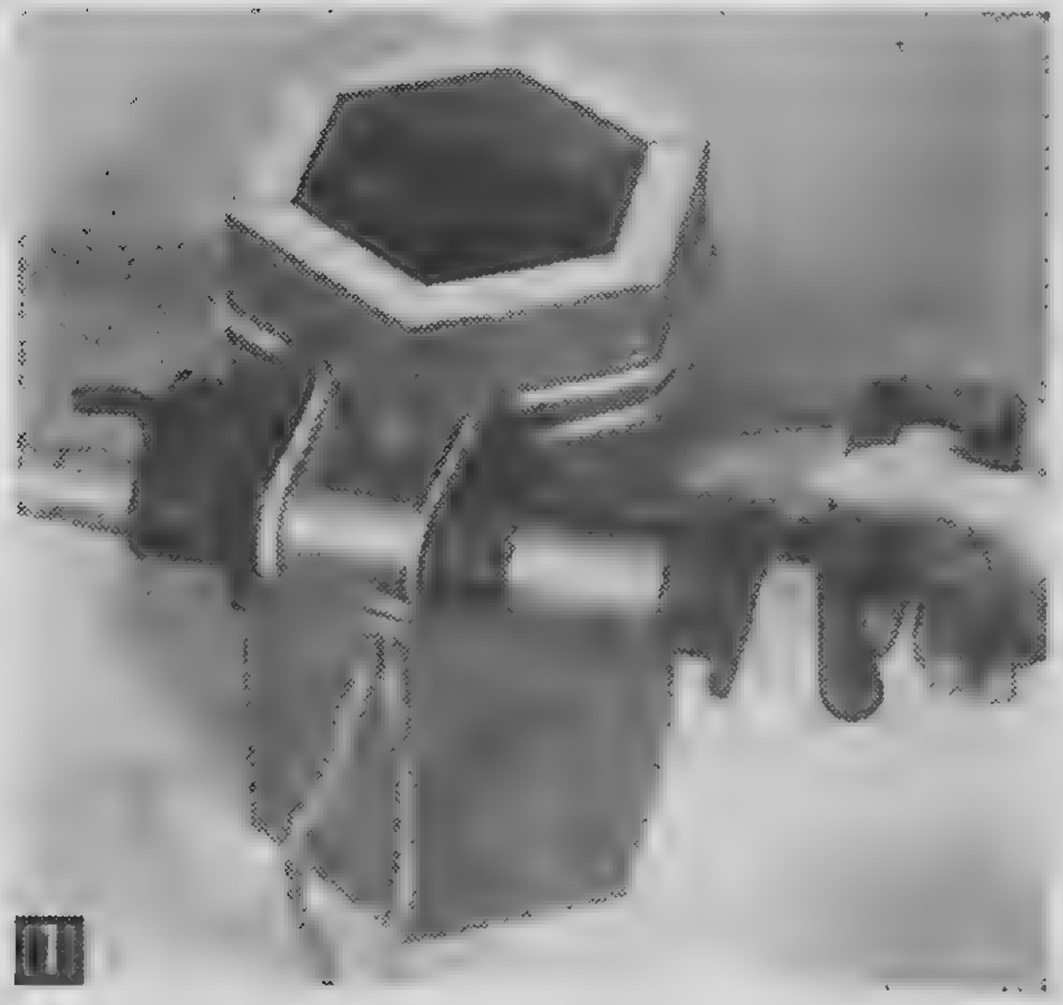
directly over the edge of the nose spar. Fold the fabric over ½ or ¾-in. (Figs 3A and 3B), stretching it as you go. Excessive tightness is not necessary; the fabric will shrink when doped, so just pull it out snugly. Then tack or staple it along one of the outer spars, following Fig. 3A.

Next, pull the fabric out smoothly over the other outer spar to determine width and trim off the excess with scissors, leaving just enough to fold under when tacking, as before. Then repeat this procedure at the trailing edge spar, folding the fabric neatly at the corners. Finally, fasten the fabric to the center rib using a piece of ½-in. wide dressmakers binding tape under the tacks or staples, to prevent the force of the wind from tearing the fabric loose from the fastenings.

Dope the entire surface three coats with regular airplane dope, allowing about one hour drying time between coats. The dope will pull the fabric drum-taut. Use plenty of dope around the spars and joints to strengthen and seal the structure.

Now you are ready to look for some smooth ice and a strong breeze—no, make it a mild breeze to start with, and work up to the strong breezes. Fig. 4 will give you an idea of how to change tacks going upwind. Happy skate-sailing!

Clamping Irregular Work



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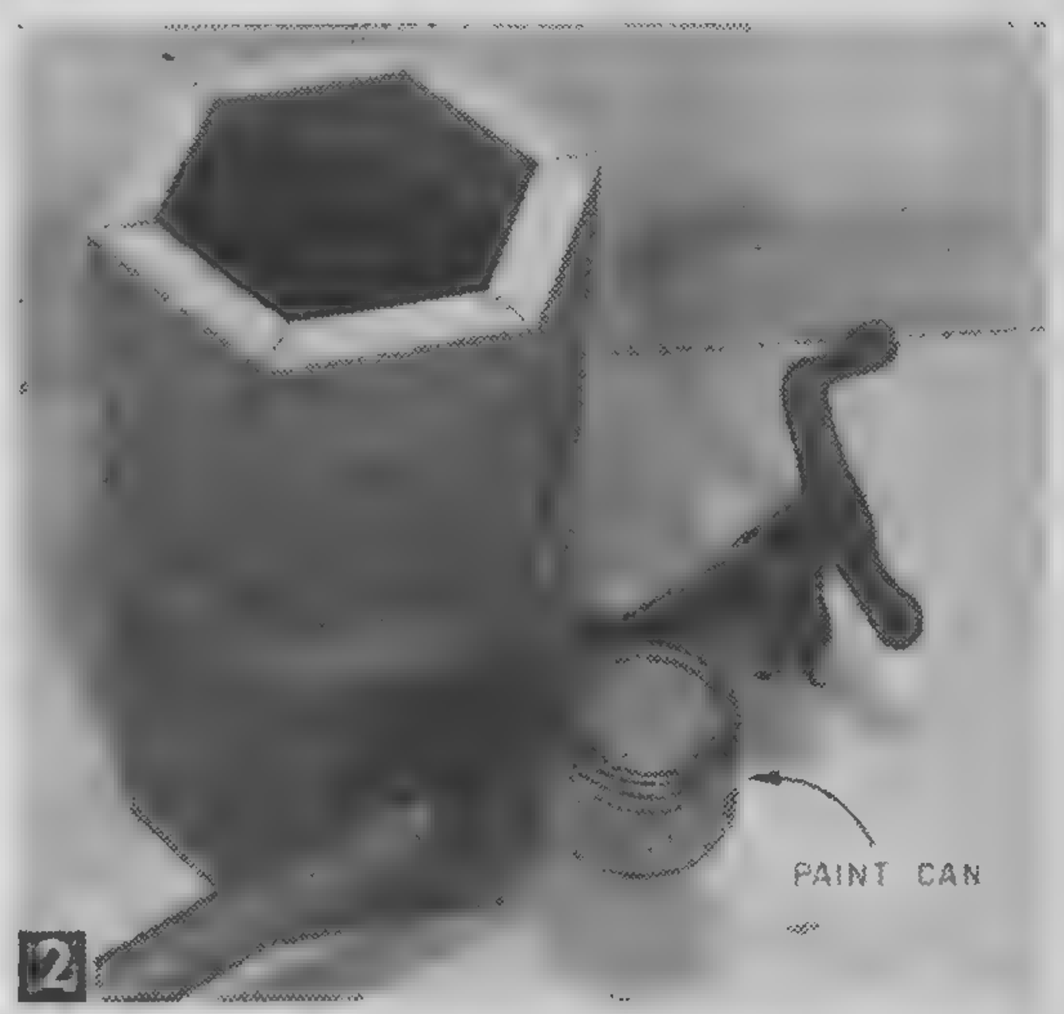

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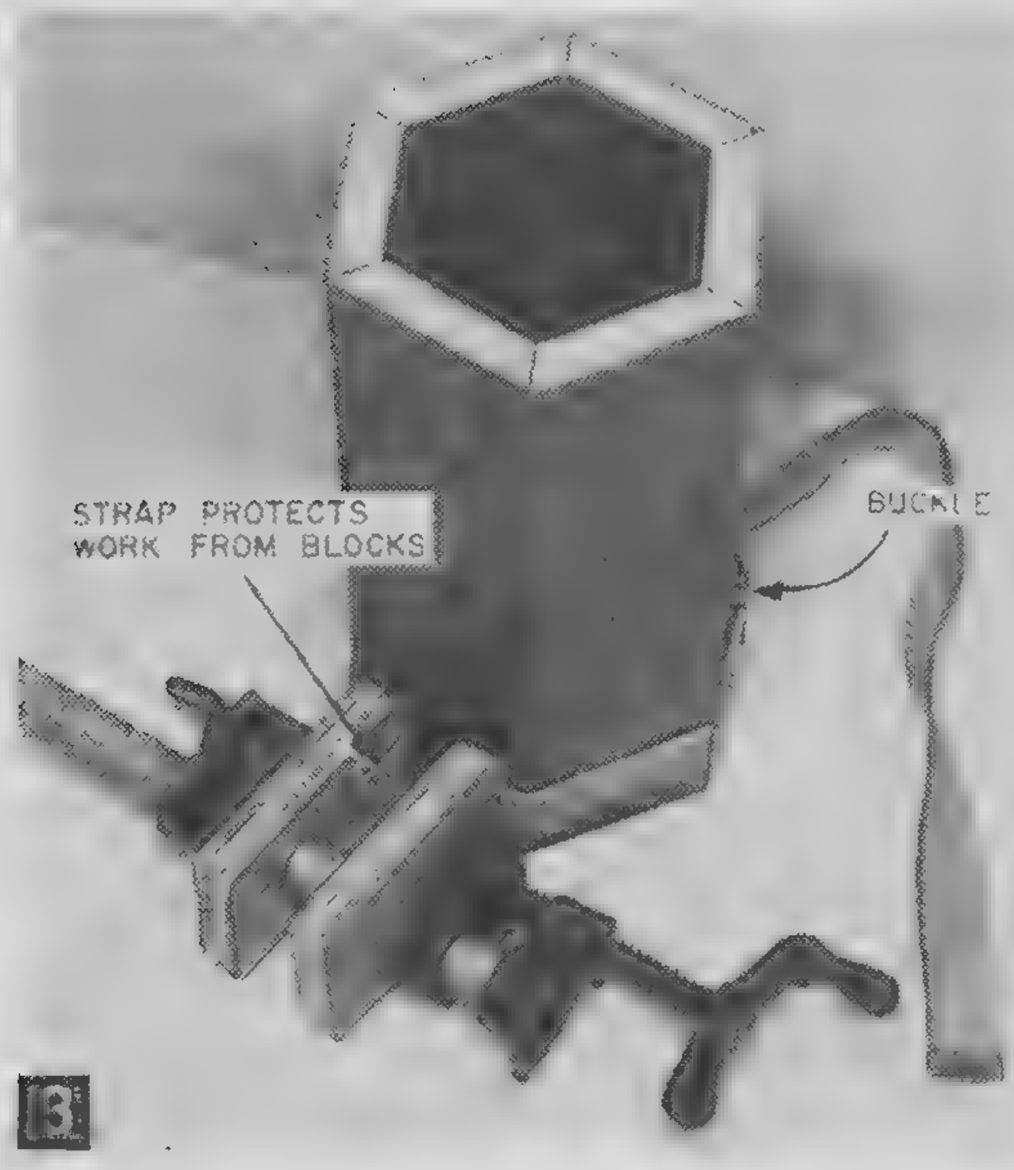
Complicated glued-up assemblies can be clamped easily with the aid of common shop items, such as a clothesline (above left) or web strap (above right). For frequent use on odd shapes and sizes, try the clamping arrangement (below left).



3

HOW WOULD you go about clamping odd-shaped work like a hexagon column while glueing it?

Well, how about wrapping a stout piece of cord or rope around a pipe clamp (Fig. 1) going around the work and back around the pipe? Now with the rope between the clamp jaws and the work, tighten the clamp.

Or you might use a web belt or strap instead of the rope (Fig. 2) and place a cylindrical object such as a small paint can inside the loop. Leave just enough slack to allow the clamp jaws to draw the strap together. An ordinary C clamp will work here.

If you have this problem often, try something a little more permanent and versatile. Use two straps which can buckle together on one end and run the other ends through slots in plywood blocks (Fig. 3), screwing the ends to the wood so they cover the edges of the blocks. Drill the blocks to fit over the pipe clamp. Adjust the strap, leaving 2-3 in. between the block for tightening the clamp.—R. HANSCOM.

Ready-to-Hang Hinges

• To have hinges, hasps and the right screws all in one place when you're out on a job, prepare them before you leave the shop.

Place the right-size screws in the screw holes and then fold each hinge back on itself, taping it to prevent loss of the screws.

Hard-Cover Bindings for Magazines


A

Now you can hand-bind those back copies of your favorite magazines or paperbacks and repair worn books at home

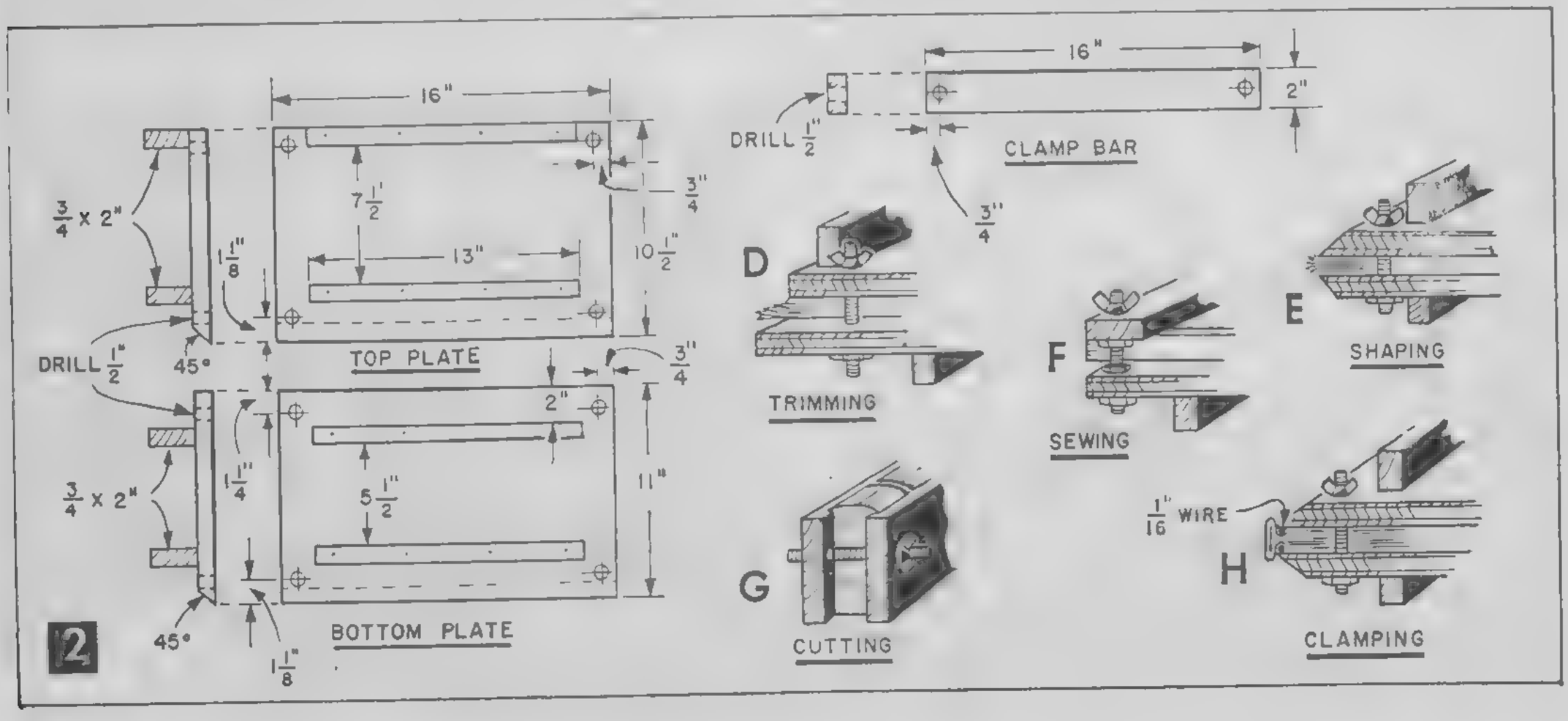
By ROLFE F. SCHELL

A COMBINATION press, built of readily available materials, is the only special equipment necessary to make durable, professional looking bindings in your shop for 30¢-90¢ each.

Most of the materials used to bind these are in your house right now. Or, if you wish, you can purchase special bookbinding materials and even kits to bind paperbacks. Also, you can repair those broken-down hard bound books with the same technique and equipment.

The Combination Press is made up of two ¾-in. plywood plates and a pair of ¾-in. hardwood clamping bars (Fig. 1A). Cut and bevel the plates and attach the crossmembers with glue and nails as in Fig. 2. Drill the ½-in. holes for the four 6-in. lengths of threaded rod. Note that the holes are located differently in the top and bottom plates and that the rear crossmember on the top plate is set flush with the edge of the plate. The plates and bars will be assembled in various ways to serve as clamps while cutting, sewing and shaping the binding. Three ordinary nuts and a wing nut are used with washers on each rod to position the plates and bars.

The first step in magazine binding is to separate the printed sections or signatures. Dampen the bound back of the magazines so the glue will soften and the cover can come off



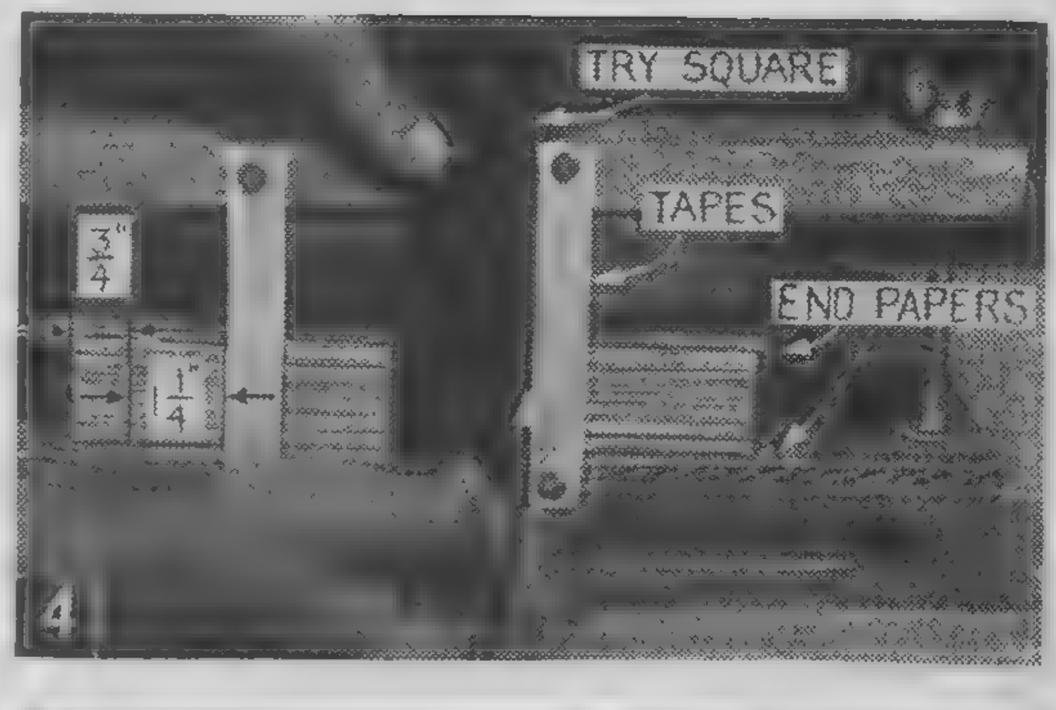
in one piece. Then remove the staples and carefully separate the signatures.

Throw away the unwanted pages and remove the old glue from the folded edges of the signatures. If a page should tear away from a signature, or when adding a single sheet such as the index, cover all except ⅛ in. of the page with paper. Brush the glue and glycerin mixture along the exposed edge (Fig. 6) and then press the page to the adjoining section until dry. Cut each month's index from the magazine and mount them on different colors of construction paper (Fig. 3) glued to the appropriate section in this way.

The preparation for binding paper-backed books is similar. If you are rebinding a damaged hard-bound book, remove the casing carefully to uncover the stitched back of the binding. Clean away the old glue and cut the stitches. Connect pages that have torn along the fold by gluing them to a strip of onion skin paper and replace them in their original position. In the case of a single loose page, attach it to a similar strip and fold the strip in with the rest of the signature.

Next make up the end papers (Fig. 3) which are the blank pages at each end of a book that protect the outermost printed pages. In rebinding it is usually best to replace the end papers. However, if the papers are decorated and in good condition, it will be worthwhile to spend some time softening the glue and salvaging the papers.

When making your own end papers, use heavy stock such as brown kraft or construction paper. Select four sheets that when folded will be ½-in. greater than the pages in length and width. 10 x 13½ in. is the correct size for SCIENCE and MECHANICS magazine. Fold these sheets in half and, with the leaves running in opposite directions, lap the folded edges of each pair ⅛ in. and glue them (Fig. 3). When dry, fold the top sheet back on itself and fold the next sheet down and under.

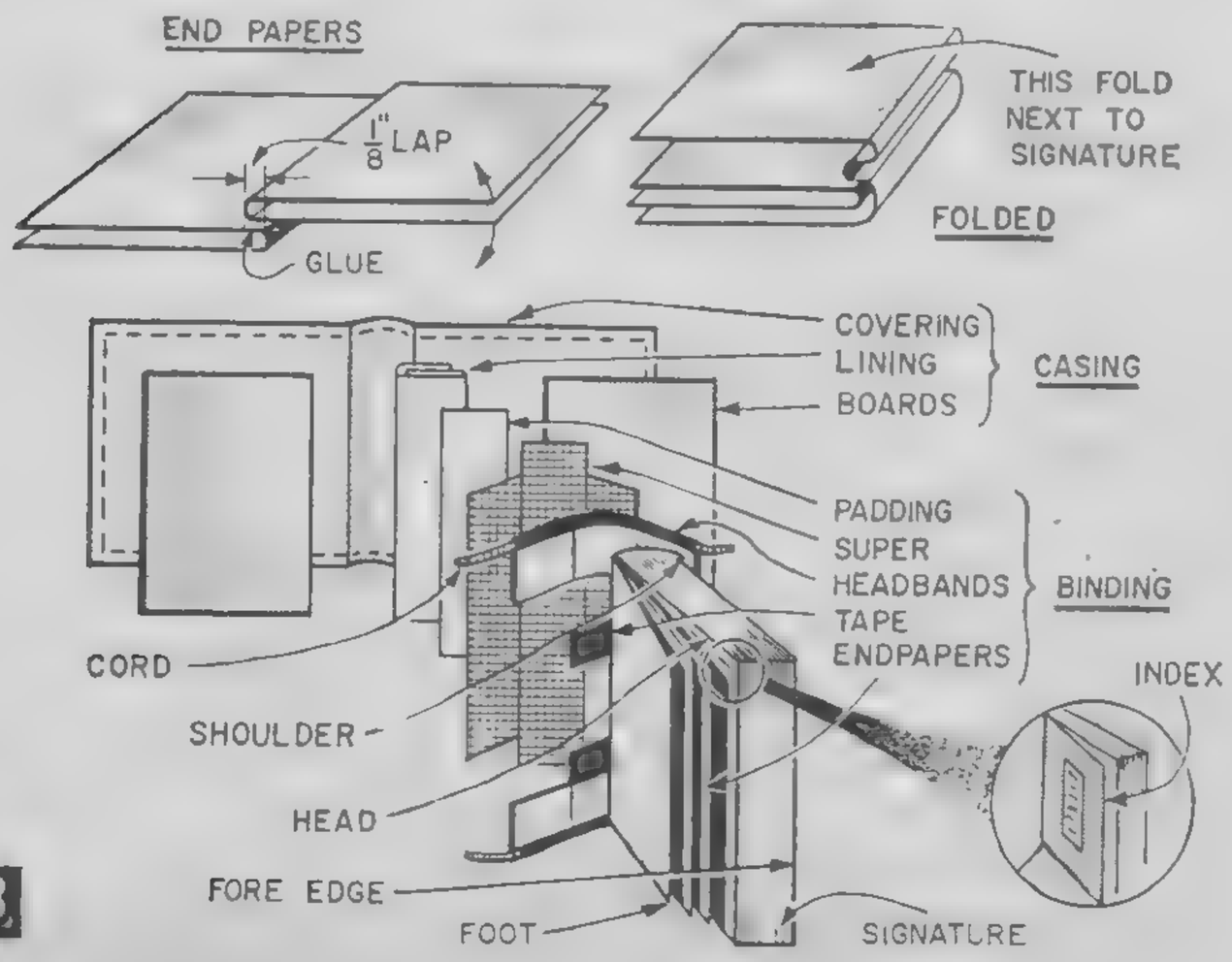


Stacked signatures are marked in sewing frame and then clamped between bars while cutting openings for thread.

Set one of the clamping bars at about twice the thickness of the book above the bottom plate and lay the signatures under the bar with their folded edges toward you. Now place an end paper at the front and back of the signatures so that the top of the page (head) and the back, which is to be bound, are square and even. Then with a pencil and try square, mark a line ¾ in. from each end of the sections (Fig. 4). Thumbtack two pieces of ⅝- or ¾-in. binding tape between the clamp bar and the base 1¼ in. from the pencil lines and mark lines on both sides of each tape.

Now, without removing the tape from the sewing frame, carefully remove the signatures and place them between two clamping bars. Allow the folded backs to extend about 3/16 in. from the bars and tighten the wing nuts carefully. Then saw a groove ⅛ in. deep across the back at each mark (Fig. 4A) with a handsaw.

Sewing. You are now ready to begin sewing. Use a 1-1½-in. needle and 18/2 linen thread to sew the signatures together. If there are



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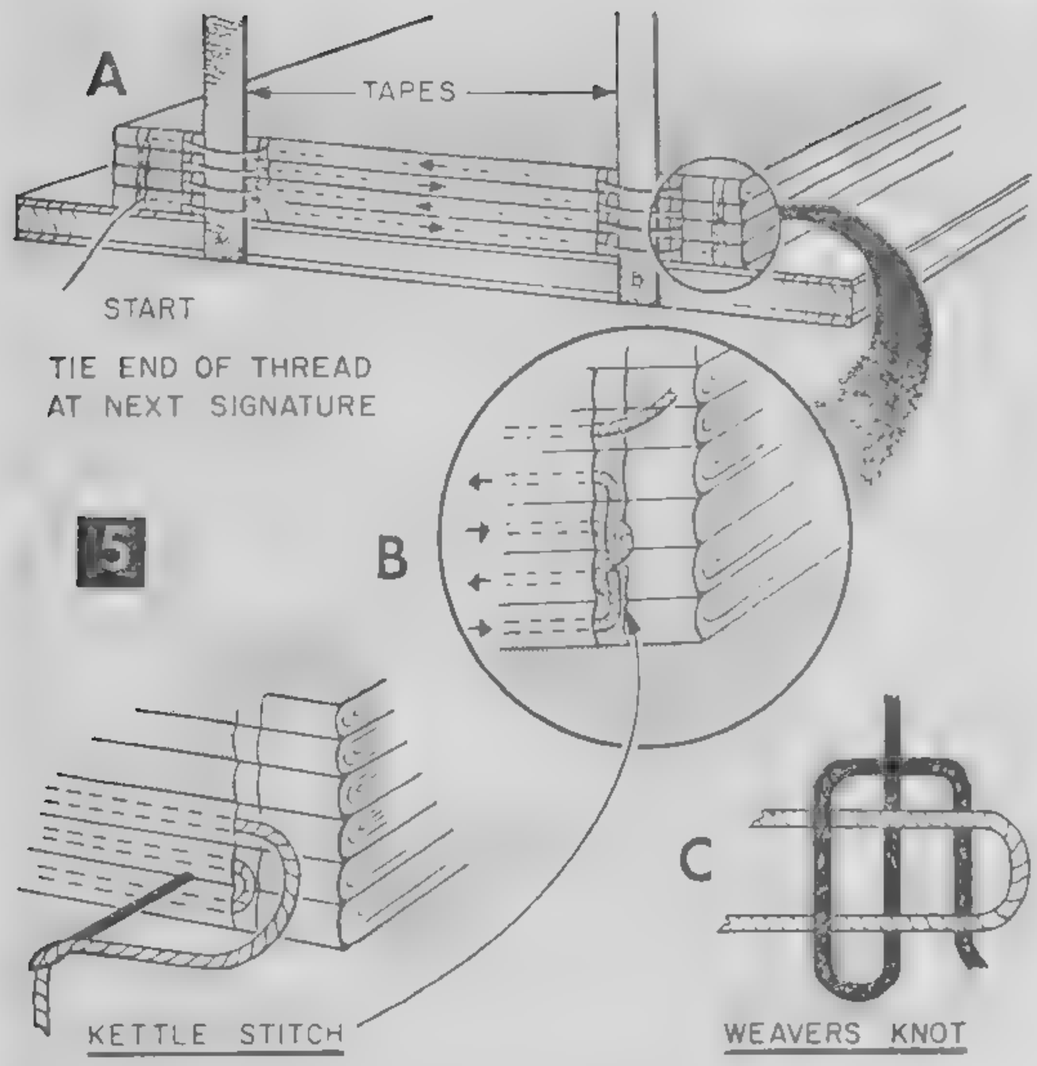


5

only three or four sections, doubling the thread will add thickness to the back. This extra thickness is desirable for appearance and will of course make the book stronger. Since the binding is sewn together from the back of the book to the front, begin by placing the back end paper with its inside face up on the bottom plate of the sewing frame.

Hold the paper open at the accordion pleat with the left hand and insert the threaded needle at the first saw cut on the left. Pass it inside of the paper and come out the next saw cut. Go on around the tape, in the next cut, and continue as in Fig. 5 to bring the needle out of the last cut. It is not necessary to turn the needle around each time you pass it through a cut. It is easier to back it out, without reversing, and go forward through the next cut.

When the end paper is sewn to the tapes, pull the thread until only a few inches remain

6

Use sheet of cardboard or paper to mask pages while gluing single sheets or joining end signatures after sewing.

at the point where you started sewing. Then place the last printed section of the book on top of the end paper and repeat the same sewing procedure, working from right to left. When finished, pull the thread tight and tie it to the end of the thread at the left of the end paper. Be sure to have the signatures opened at the center of the fold so all pages will be sewn in. Also be sure that they are in their proper order and facing in the same direction.

After sewing the third signature (left to right) join the right end of it to the preceding signature with the "kettle" stitch (Fig. 5B). Make this stitch by passing the needle through the thread joining the two preceding signatures and bring it up through the loop that is formed in the process. Pull the stitch tight to form a knot which holds the signatures together. When you run out of thread, tie another piece on with a weaver's knot (Fig. 5C) which holds well and can be tied closely to the book.

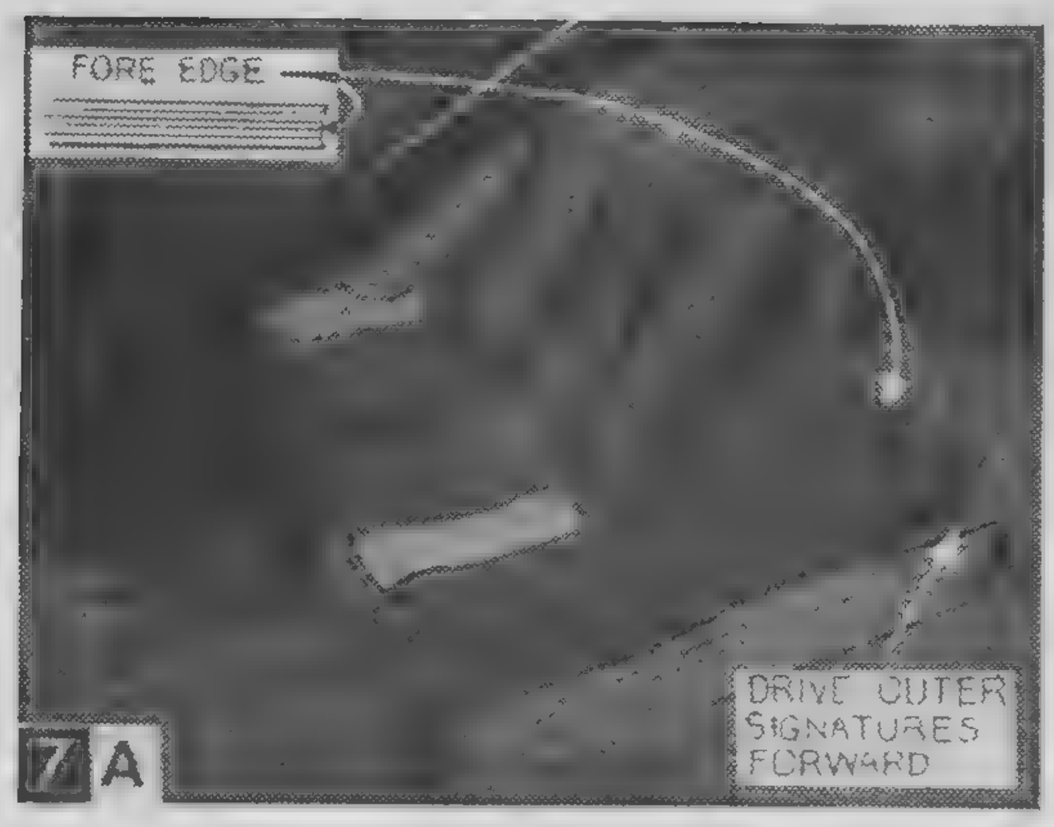
Continue sewing in this way, stopping after every four or five signatures are sewn, to hammer the stitched back down lightly to keep it from becoming too thick during the sewing process. When the last signatures are sewn in place, remove the binding from the sewing frame. Adjust the tapes so they are evenly distributed on each side of the back.

Backing. Next set up the press with the four rods and the plywood plates to hold the binding while gluing the back. To hold the outer signatures in place while the binding is clamped up, open it between the third and fourth sections from one end. Cover all but a ⅛-in. strip along the hinge edge of each adjoining page with a sheet of paper (Fig. 6). Brush glue along the exposed strip and then repeat the process for the three sections on each end of the binding.

Now working quickly before the glue dries, align the tops and back of the signatures and clamp them with about ¼ in. of their backs extending beyond the beveled edge of the plates. Prevent the binding from sticking to the plates by inserting a double thickness of wax paper between it and the press plates. Saturate the exposed ends of the sections with the glue. Loosen the wing nuts slightly for just a moment to allow the glue to seep into the joint and then retighten them. Be sure the glue does not run down into the sections. Before the glue dries, stretch the tapes out evenly so there are no wrinkles.

Trimming. After the glue has dried, remove the binding and clamp it in the rear edge of the press. Place a piece of cardboard underneath it and line up the page edges with the top plate so they can be trimmed while removing as little paper as possible.

Hold a well-honed wood chisel against the flush crossmember of the plate (Fig. 8) and tilt the cutting edge slightly upward in the



Rounding (left) and shouldering are important steps in making a strong, easy to use binding.

MATERIALS LIST—COMBINATION PRESS

No. Req.	Size and Description	Use
1	¾ x 11 x 16" plywood	bottom plate
1	¾ x 10½ x 16" plywood	top plate
4	¾ x 1⅝ x 13" oak	crossmembers
2	¾ x 1⅝ x 16" oak	clamping bars
4	½" dia. x 6" threaded rod	
8	½" nuts to fit threaded rod	
4	½" wing nuts to fit threaded rod	
16	½" flat washers	

MATERIALS LIST—MAGAZINE BINDING
(SIX ISSUES OF SCIENCE and MECHANICS)

No. Req.	Size and Description	Use
4	10 x 13½" kraft paper	end papers and reinforcements
6	10 x 13½" construction paper	index pages
2	1/16 x 7 x 10" cardboard or bookbinder's board	cover boards
1	11 x 18" bookcloth, denim or leatherette	cover
1	6 x 11" cheesecloth, crinoline, crash	super
2	6-in. lengths of ⅝" or ¾" dressmaker's tape	
1	1-1½" straight needle	
30 yds.	18/2 linen thread	
½ pt.	Elmer's Glue-All mixed with ⅓ oz. glycerin	
½ pt.	clear varnish, shellac	

Bookbinding materials available from: J. L. Hammett Co., Kendall Sq., Cambridge, Mass.

direction of the cut. Then with a very light pressure, push the chisel along the pages, removing just a few sheets at a time. Continue this, always working in the same direction until the edges are smooth and square. Then reclamp the binding and trim the head and foot in the same way.

Shaping. Next moisten the back of the binding with a wet cloth until the glue is soft. When it is, lay the binding on its side with the fore edge toward you. Place your thumb against the middle of the fore edge with your fingers on top and pull the top pages toward you while hammering lightly along the upper edge of the back with a rubber or plastic hammer. Strike glancing blows to drive the outer signatures toward the fore edge. Turn the binding over and continue on the other side until you have formed a well-rounded back as in Fig. 7A.

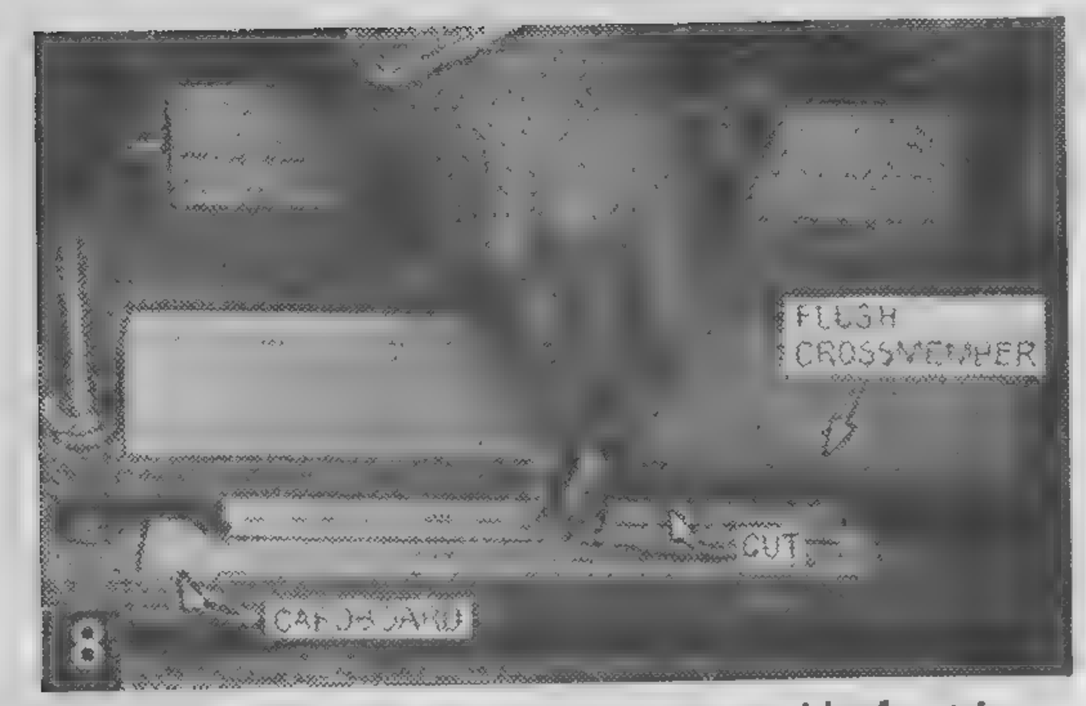
Now clamp the rounded binding tightly in the beveled edge of the gluing press with about ⅜ in. extending to form the shoulders (Fig. 7B) which hold the binding in the cover boards. The thread used in sewing gave the back additional thickness which is used to form this shoulder. Strike glancing blows with the hammer, working from the center to the outside until the shoulder is formed. Work carefully and slowly to avoid breaking the threads.

Now fold a 1-in. strip of cloth that is a little longer than twice the thickness of the binding over a piece of cord (Fig. 3) and glue the strip to itself. When the glue is dry, cut the strip into two pieces to make the headbands and glue these over the rounded edge of the back to give a professional look to the binding.

Super. Reinforce the back with a piece of loose-woven, heavily starched cloth known as "super" (Fig. 3). Crinoline, crash or bookbinder's cheesecloth will do well here. Cut a piece 1 in. longer than the pages and 4 in. wider than the thickness of the back. Center this piece over the back and glue it in place, allowing 2 in. to remain unglued on each side.

Now glue a piece of construction or kraft paper the width of the back on top of the super to cover up any irregularities and glue the projecting tapes and super to the end papers (Fig. 9). Clamp up the binding with wax paper between it and the press plates. When the super has dried, trim away all but 2 in. of the end papers, leaving a ½-in. tab at the head and foot.

Casing. Cut four pieces of 1/16-in. cardboard or bookbinder's board ½ in. larger than the height and width of the pages. Glue these together in pairs (Fig. 9), leaving a 2 in. space along the back or hinge edge unglued. Slip the tab of the super into the unglued part and



Offset rear edge of press serves as guide for trimming edges of binding. Bottom plate is protected by cardboard.

Outermost end paper, super and tapes are trimmed and glued into cover boards.

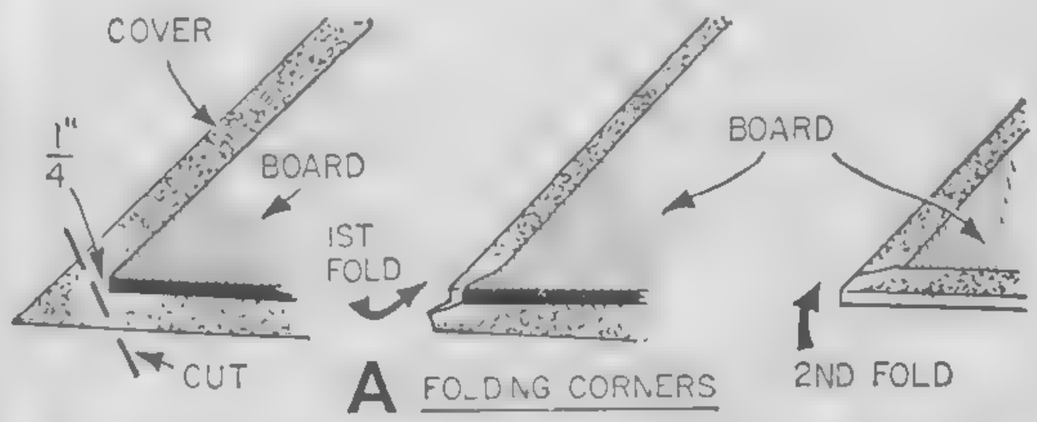
align the board with the binding, allowing a 1/16-in. clearance between the shoulder and the edge of the board. Mark the location of the pages on the boards and trim exactly 1/8 in. outside the line.

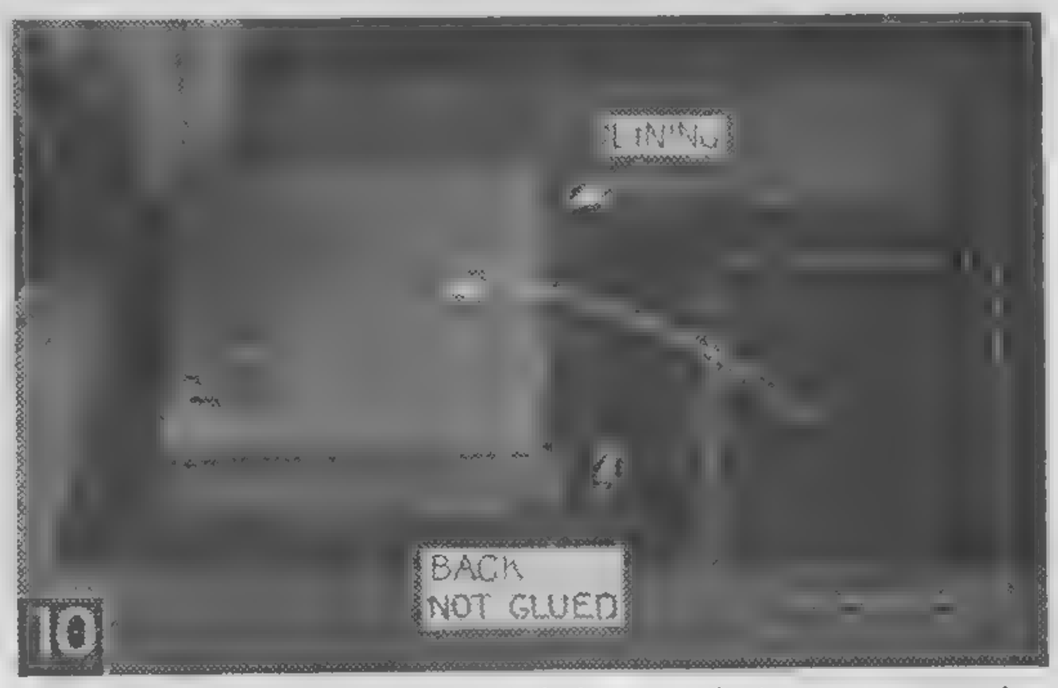
Now brush glue between the split section of the boards (Fig. 9) and insert the supers, pressing them until dry. While this is in the press, cut a piece of kraft paper that is the length of the boards and three times the width of the back. Fold this in thirds (Fig. 3) lengthwise and glue the center section to the back of the binding.

Cover. With the binding opened wide, trace its outline on wrapping paper and then make a pattern from this which is 1 in. larger on all sides. Transfer this pattern to the covering material and cut it out. For waterproof casings, fabrikoid and pyroxylin coverings are available from art supply stores. Or you can use denim or light canvas and protect it with clear shellac.

Lay the book in place on one end of the covering material and apply glue to the outside of the top board only. *Do not glue the covering to the back.* Pull the covering over the binding and press it firmly in place. Then turn the binding over and repeat the process for the other side (Fig. 10). Slit the folded lining paper for ½ in. along the hinge edge and tuck the cover material in between the lining and the head band.

Then clip off each of the four corners (Fig. 10A) to within ¼ in. of the boards. Apply glue to the inside edges of the board and fold over the material, forming the "nicked" corners. Do the same with the rear board and then put a double thickness of wax paper between the boards and the end papers and between the boards and the press plates. Before tightening the press, lay a piece of 1/16-in. straight wire in the spaces between the boards





Cloth covering is drawn tightly over lining paper and glued to boards only. Nicked corner is formed by diagonal cut at board corner.

and the shoulders (Fig. 2H) to form hinge grooves. When the cover is dry, trim away all except 3/8 in. of it on the inside of the boards. Then cover the inside of the boards with glue and press the adjacent end papers against the board and clamp as before.

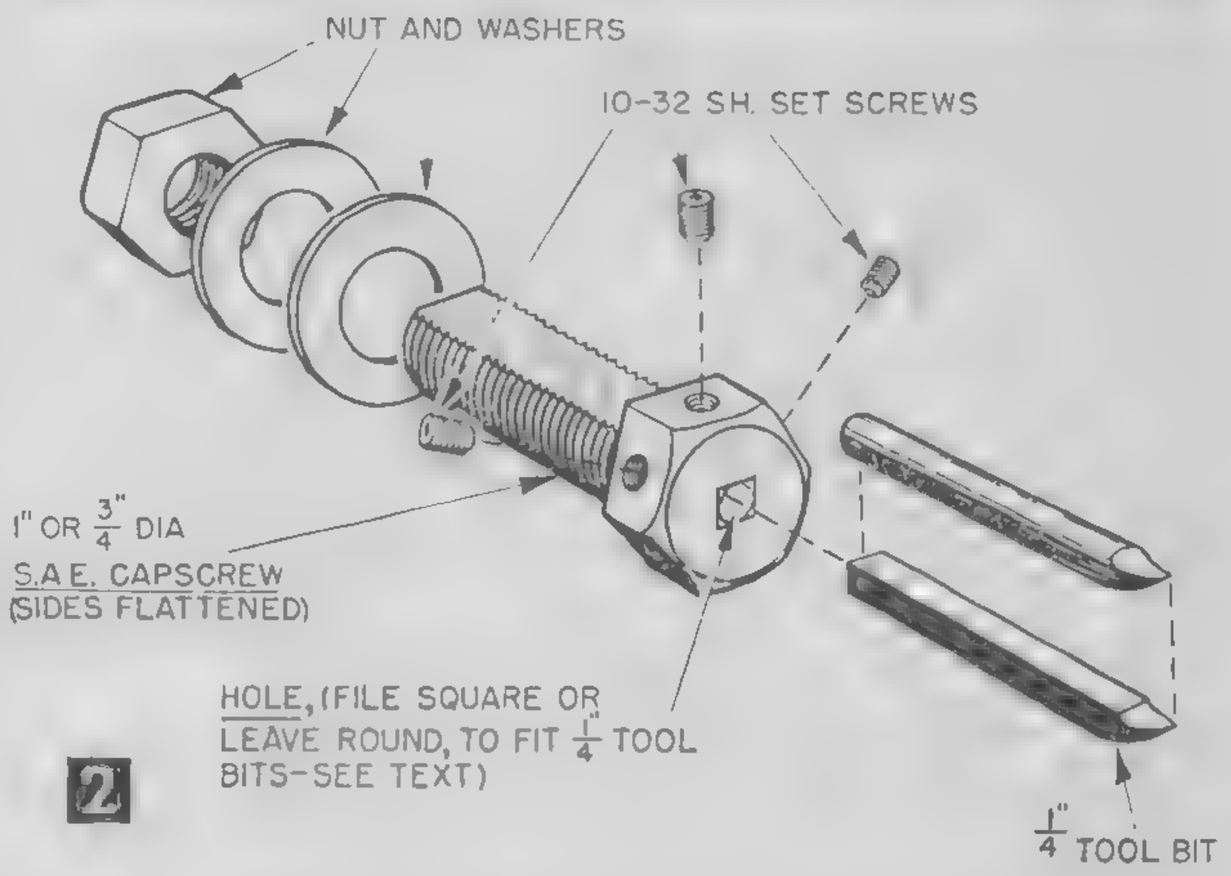
Finishing. If you expect the book to be exposed to water, oil or dirt; apply two coats of white shellac when the glue has dried. Then cut the name of the magazine from its cover and glue it to the front of the book (Fig. 1). Clip the title and date from the back of the magazine and glue it vertically along the back of the casing.

Your local artist's supply or hobby store can provide materials for gold embossing, silk screening or block printing titles and decorations on other book covers.

Fly Cutter Attachment For Small Lathes

EXTEND the versatility of your lathe with a fly cutter attachment costing about fifty cents, made from a 1-in. capscrew (fine thread preferable), a matching nut and two washers. A 1-in. dia. screw is suited for faceplates with ⅝-in. slots; if your faceplate has ½-in. slots, use a ¾-dia. screw. Length of the screw is determined by thickness of the faceplate, and clearance between it and the headstock. A 9-in. Logan will swing a 1½-in. long screw with sufficient clearance.

First chuck the screw in the lathe, holding onto the threads. Threads this size are not easily damaged and it need only be clamped tightly enough for a drilling operation. Center-drill, then drill through the screw with a 3/16-in. drill, following up with a ¼-in. drill (Fig. 1). The next step is the hardest, filing the ¼-in. square hole. Before you start filing mark two opposite sides of the hex cap with blueing for reference. Now file out the corners of the hole to a ¼-in. square shape keeping it approximately square and parallel to the two marked sides. This is to allow the center setscrew to lock the tool bit against a flat surface. Use a standard ¼-in. tool bit as a guide and file out the corners until the bit fits snugly. No great accuracy is needed as the tool bit need not be exactly central to the screw nor need it lie parallel to the body of the screw.



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On one of the two marked flats of the hex cap, drill and tap for a 10-32 setscrew. Do the same on each side of this flat so that you will have setscrews on three adjacent flats of the cap screw.

Now fit the screw to the faceplate by filing two flats on the threaded portion of the screw, with the flats parallel to the blued sides of the head. Since the faceplate is a rough casting, the faceplate slots will have to be filed slightly to even them out. File the flat portion of the screw equal to the width of the faceplate slot, so the bolt will slide up and down the slot freely. This allows the tool to be adjusted to working diameters of about 3½-in. to 5 in.

The Flycutter Is Now Complete. Place a washer on the screw, place the screw in the faceplate slot and put on the other washer and the nut. Slide the tool to the desired working diameter and lock the nut securely. Put a ¼-in. tool bit in the holder and lock it in with the setscrews so that it protrudes no more than ½ in. (Fig. 1). A few trial cuts will determine the best tool shape and clearance angles for most efficient operation.

If you have a light lathe, the off-balance condition of the fly cutter may set up vibrations. This can be remedied by mounting a capscrew of similar weight in the opposite slot of the faceplate.

You can avoid the square filing operation if you prefer by using round tool bits made from a ¼-in. x 6-in. boring bar. Mark the 6-in. shank off in 2-in. lengths, grind around the OD of the shank at the marks and snap them off by locking in a vise and tapping with a hammer. A 6-in. boring bar will make three 2-in. tool bits.—ROBERT F. KRAUSE.

Fig. 1-A. Loose wire at switch kept this portable electric drill from working. You can handle this and many similar problems by doing your own servicing to keep tools in top working order.

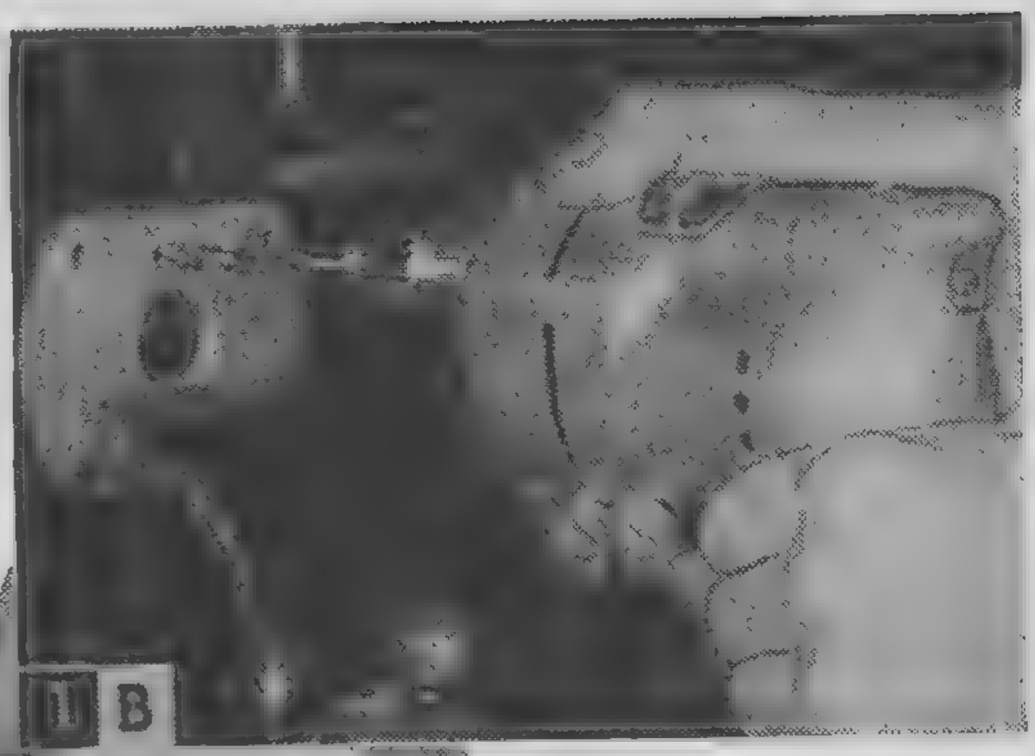


Fig. 1-B. Fully assembled drill can be tested in use—drilling a ¼-in. hole through plate steel. Any drill in good working order should handle ¼-in. drill with only a small drop in speed and without stalling.

Servicing Portable Electric Drills

How to keep that workhorse of your workshop in top working order

By HAROLD P. STRAND

THERE'S very little around the shop your most versatile tool, the portable electric drill, won't do—from drilling holes and polishing or sanding, down to stirring paint. When you depend on a tool like this for so many jobs, you'll want to keep it working at full efficiency and be able to fix it in case it quits.

Basically, electric drills are quite simple—an *ac-dc* motor that drives a chuck for drills at reduced speed through a set of gears. As an example of the servicing operations you might expect on a typical portable electric drill, let's consider the popular Black and Decker *Home-Utility* model. The one I had would not start when plugged in and the switch depressed. A symptom like that indicates an open circuit somewhere, so I started to take the drill apart (Fig. 2), removing the front section of the drill's housing as in Fig. 3.

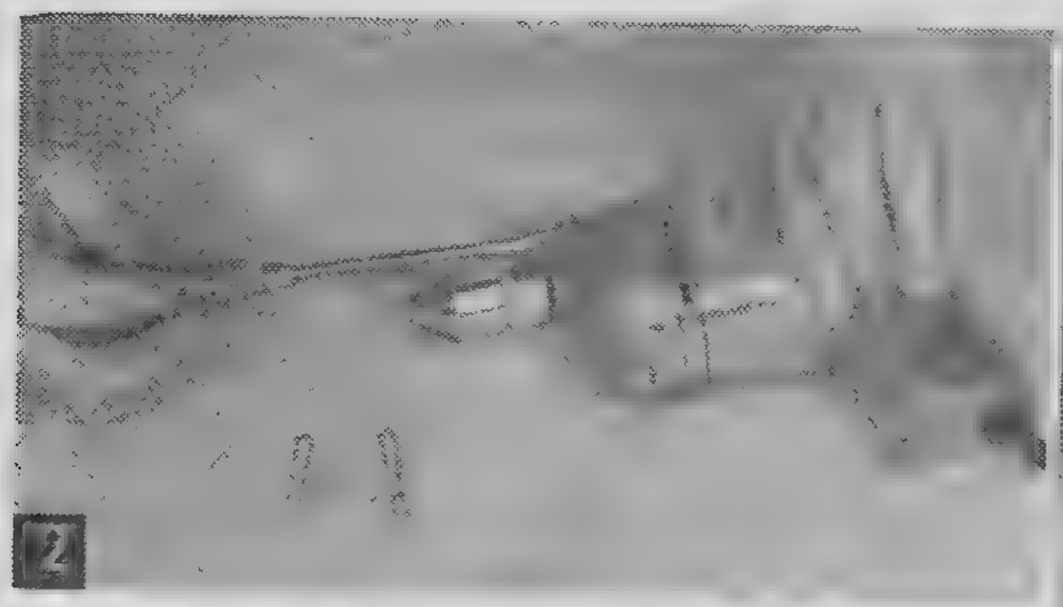
With the front section off, you can lift out the bearing plate and the large gear. If your trouble happens to be noisy operation with perhaps a loss of power or speed, it may be due to dried-up or inadequate grease in the gear chamber. If that's the case, simply wash out the space with carbon-tet or gasoline (work in a well-ventilated place and take care against fire) and fill with a good grade of medium cup grease.

However, our case seems to be of electrical origin, and the next step is to remove the handle (Fig. 4) and the carbon brushes (Fig. 5). You can now draw out the armature.

The commutator of this drill showed the normal discoloration and the surface was smooth—no trouble there. If a groove had been worn in the segments of the commutator by the brushes or the surface appeared rough, you should turn the commutator down in a lathe.

While you have the armature out, check it for shorts in a growler (Fig. 6. See *Home Workshop Handbook*, Vol. 4, p. 139, for instructions on how to build your own growler). I located a short on one side of the armature. However, these shorts can develop from particles between commutator segments, and I used a sharp pointed tool, as in Fig. 7, to clean out spaces thoroughly. A second test on the growler showed that cleaning out segments cleared up the short. If cleaning should not cure the trouble, you must obtain a new or rewound armature from the manufacturer. Low speed, loss of power and excessive sparking at the brushes usually indicates a shorted armature.

You can also test the armature with an ohmmeter (Fig. 8) if a growler is not available or as a double-check on the growler. Shorted coils will show variable readings, rather than uni-



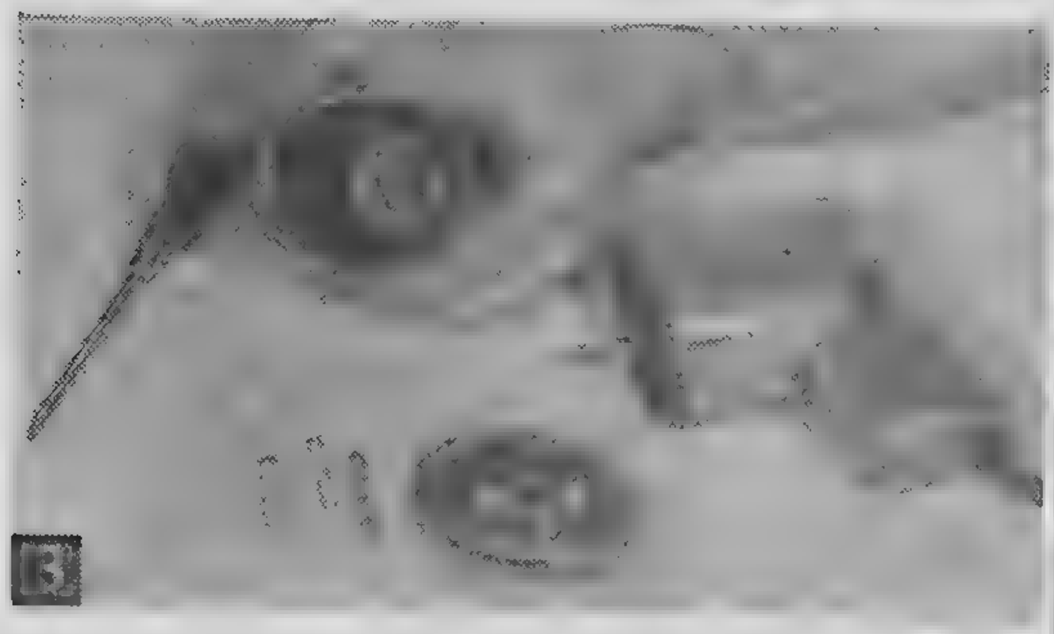


Fig. 2. First step in taking this electric drill apart is to loosen and remove three screws in front gear case.

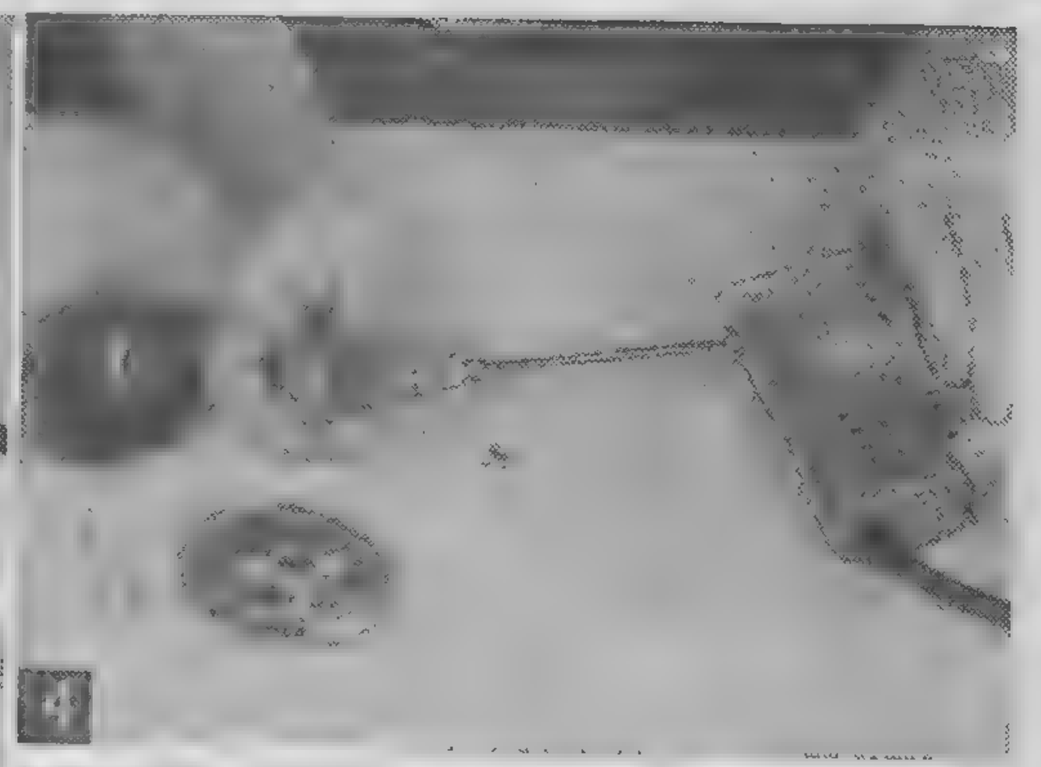
Fig. 3. Front section and bearing plate removed. Noisy operation can result from dried out or insufficient grease. Thrust bearing, series of steel balls working between two hardened discs, takes thrust from pressing on drill.

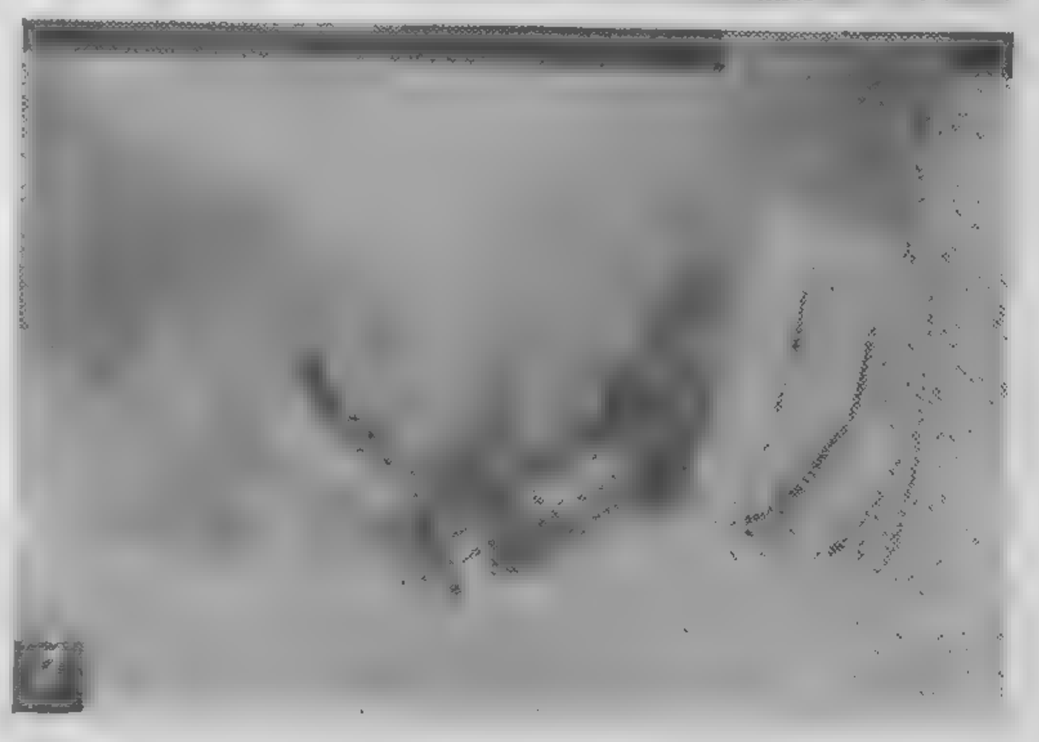
Fig. 4. Removing handle by taking out two screws at back.

Fig. 5. To remove brushes, first remove insulating threaded plugs in the brush holders. Then pull out brushes by their springs. Remove armature from field.

Fig. 6. Checking armature for shorts in the growler. Armature is rotated slowly by hand with a thin piece of steel on top of core. A short in any coil causes steel strip to vibrate from magnetic field induced in core by short.

Fig. 7. Short in armature may be due to particles of carbon or copper between bars of commutator. Clean slots with a sharp pointed tool and test again on growler.





form readings from an armature in good condition. A slight variation in readings does not always indicate shorts, however, since length of wires in coils will vary slightly, depending on whether they are top or bottom coils. Open circuits are indicated on the ohmmeter when the needle points to infinity.

A test that shows a grounded armature can be made with a series lamp (Fig. 9), which is part of the growler. With one test probe on the core windings and the other touching each commutator segment in turn, the lamp in series should not light.

Further examination of the drill's interior revealed the trouble—a broken wire at one of the switch terminals (Fig. 10). To repair this broken wire, I removed the terminal lug still attached under the switch screw, prying open the metal that was originally folded over the wire. I inserted the bared end of the wire and

soldered it in place (Fig. 1).

After correcting the loose switch wire, I tested the field-coil winding with the ohmmeter (Fig. 11A). From the diagram in Fig 11B you can see that placing a test probe on one brush holder and touching the other test probe to the splice from which the solderless connector has been removed completes the circuit to one field. Reading on the ohmmeter was about 2½ ohms. Testing the second field coil should indicate a similar reading. A low reading in one field coil compared to the other field coil indicates a shorted coil. If either of the field coils has an open circuit, ohmmeter would indicate infinity. With two uniform readings, you can assume the field coils are okay. However, you should ground-check the field coils by touching one test probe of a series lamp to the frame and the other probe to each brush holder. In such a test, no light should show.

A switch test is next. Clip leads from a series test lamp to both sides of the switch (Fig. 12). Operate the switch by hand several times, taking care not to touch the terminals. Test lamp should go *On* and *Off* without any indication of a flicker due to poor contact. Replace any defective part by writing to the manufacturer or contacting a dealer supplying parts for your model.

Before reassembling the drill, check length of the brushes (Fig. 13). Brushes in this drill were about ½ in. long, close to their original length, and okay for continued use. Brushes shorter than 5/16 in. should be replaced.

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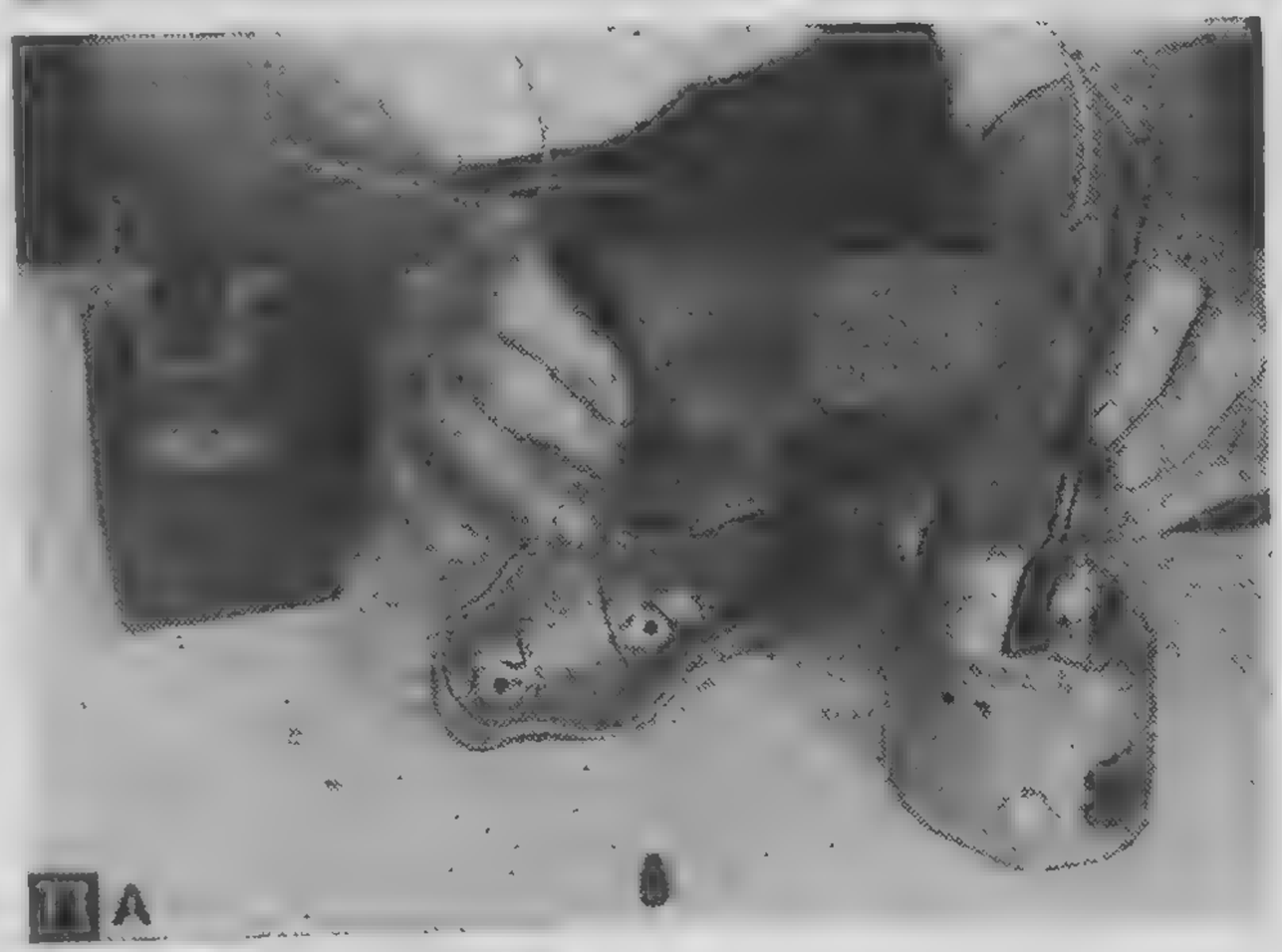
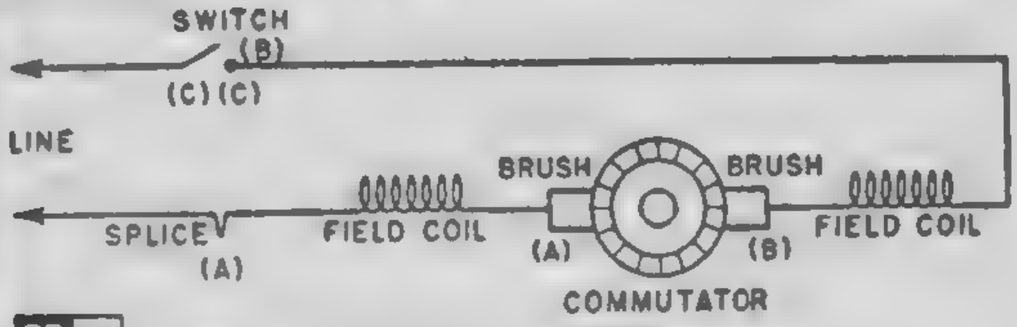
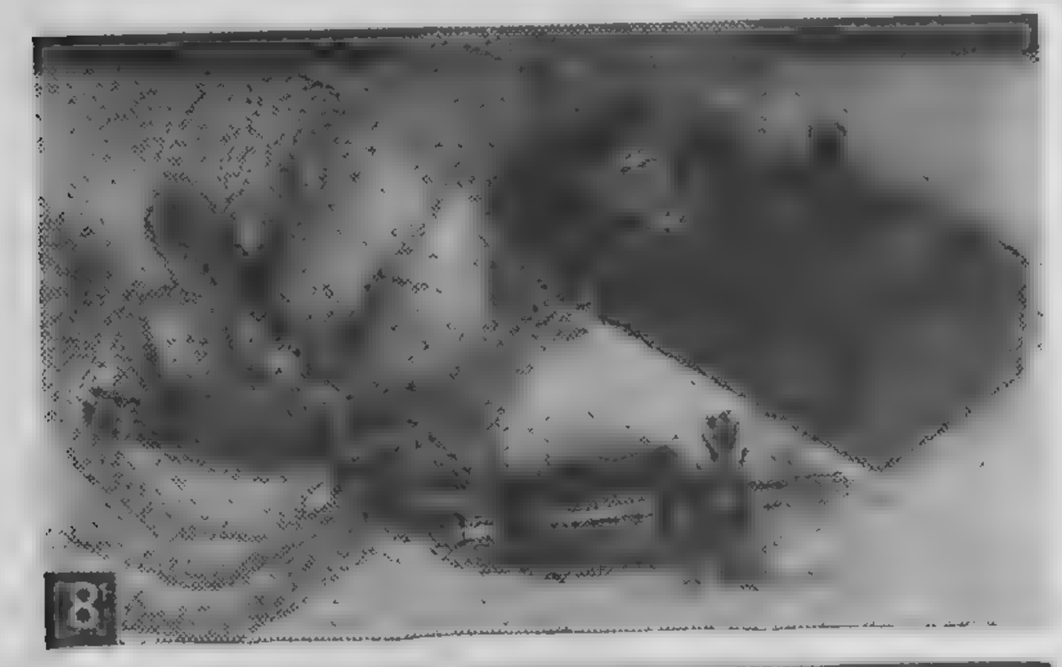


11 A



11 B DIAGRAM OF UNIVERSAL MOTOR



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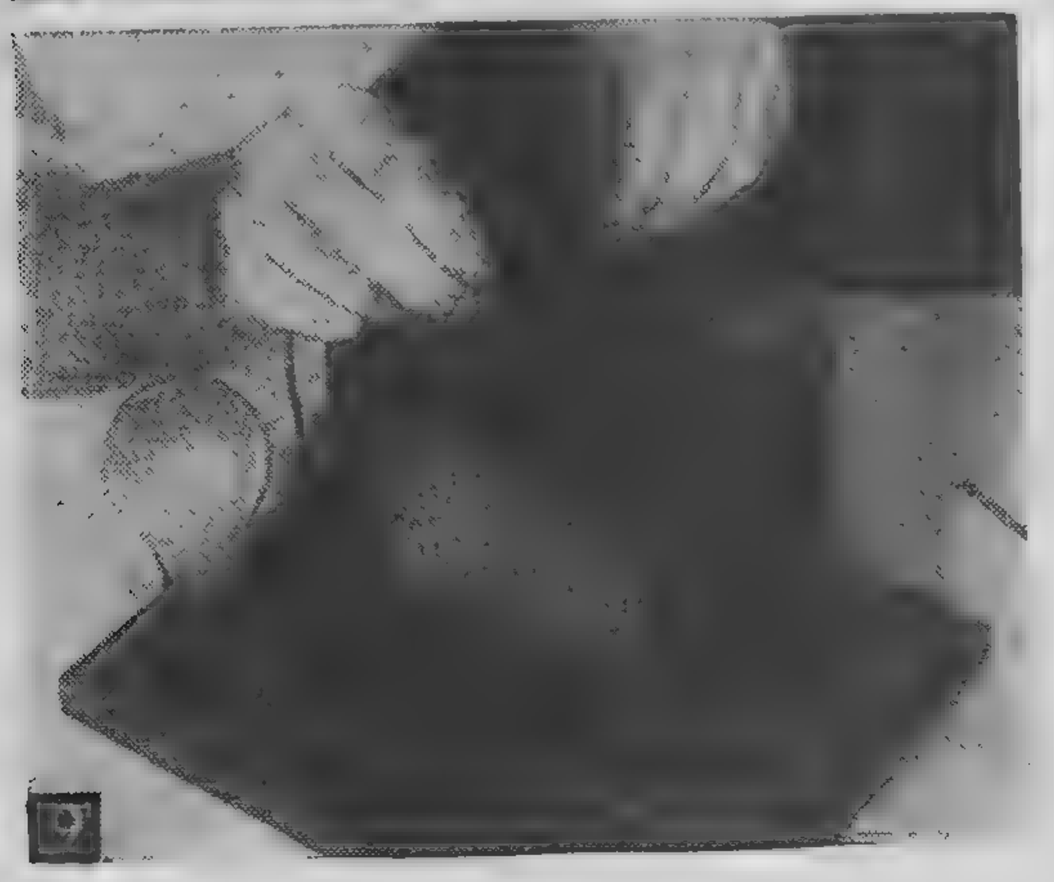


Fig. 8. Checking armature windings with ohmmeter. Touch probes to adjacent segments. Open circuits register infinity on meter. Resistance in each coil on this armature measures about 2½ ohms. Clean surface of commutator with fine sandpaper for good contact.

Fig. 9. Ground-checking armature to determine if windings are grounded to core. Series lamp should not light when test probes are touched between commutator bars and core.

Fig. 10. Broken wire at switch prevented motor from starting.

Fig. 11. (A) Testing field windings with probes and ohmmeter. (B) Wiring diagram of drill. Touching probes of ohmmeter to points A-A and B-B checks out field coils. Points C-C check out switch. Line cord is not plugged in with either test.

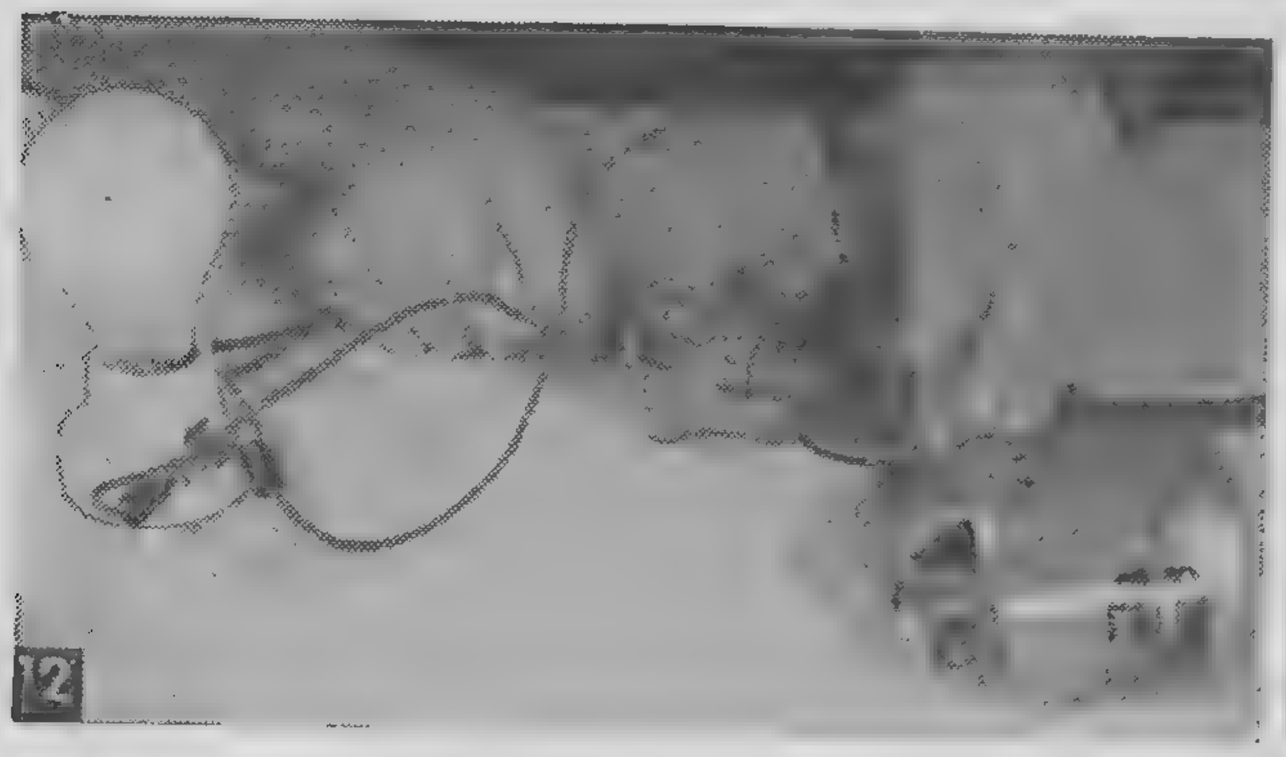


Fig. 12. Checking switch operation with series lamp. Connect clip leads across switch terminals and operate several times to make sure of switch contacts.

Fig. 13. Examine brushes before reassembling motor. Springs should be in good condition and brushes between ⅜ and ½ in. in length for good commutator contact.

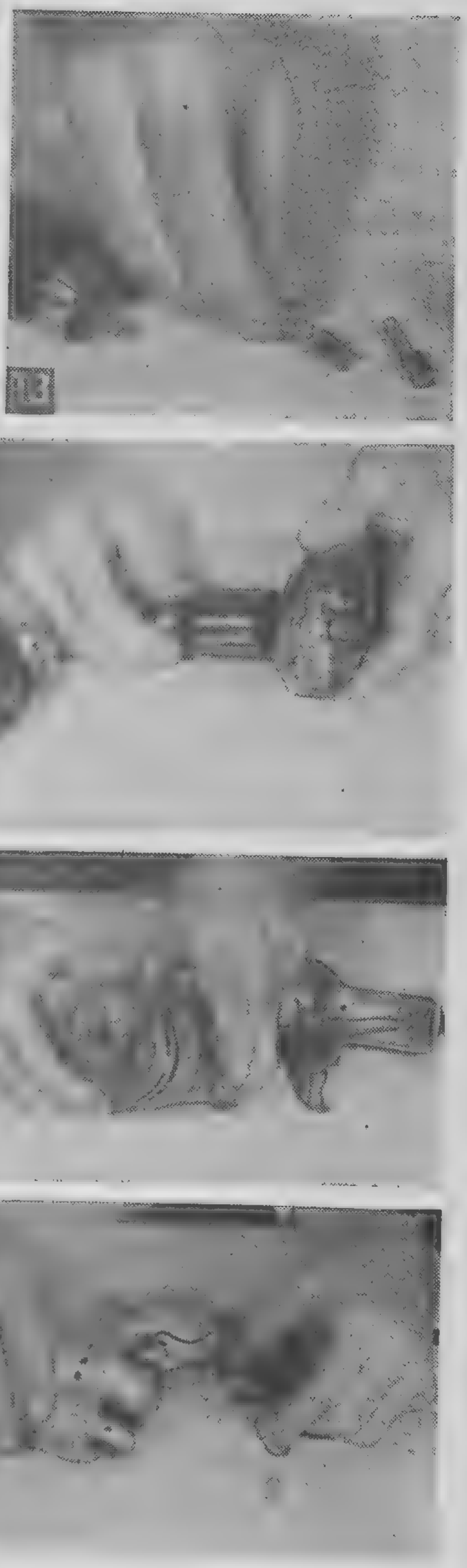
Fig. 14. Checking fit of armature shaft in its bearing by rocking plate. Slight amount of play is acceptable, but excess lost motion or wobble requires a new bushing.

Fig. 15. For reassembling drill, place armature in field, slip on fan plate and follow with bearing plate. Assemble front section with the chuck to complete front end.

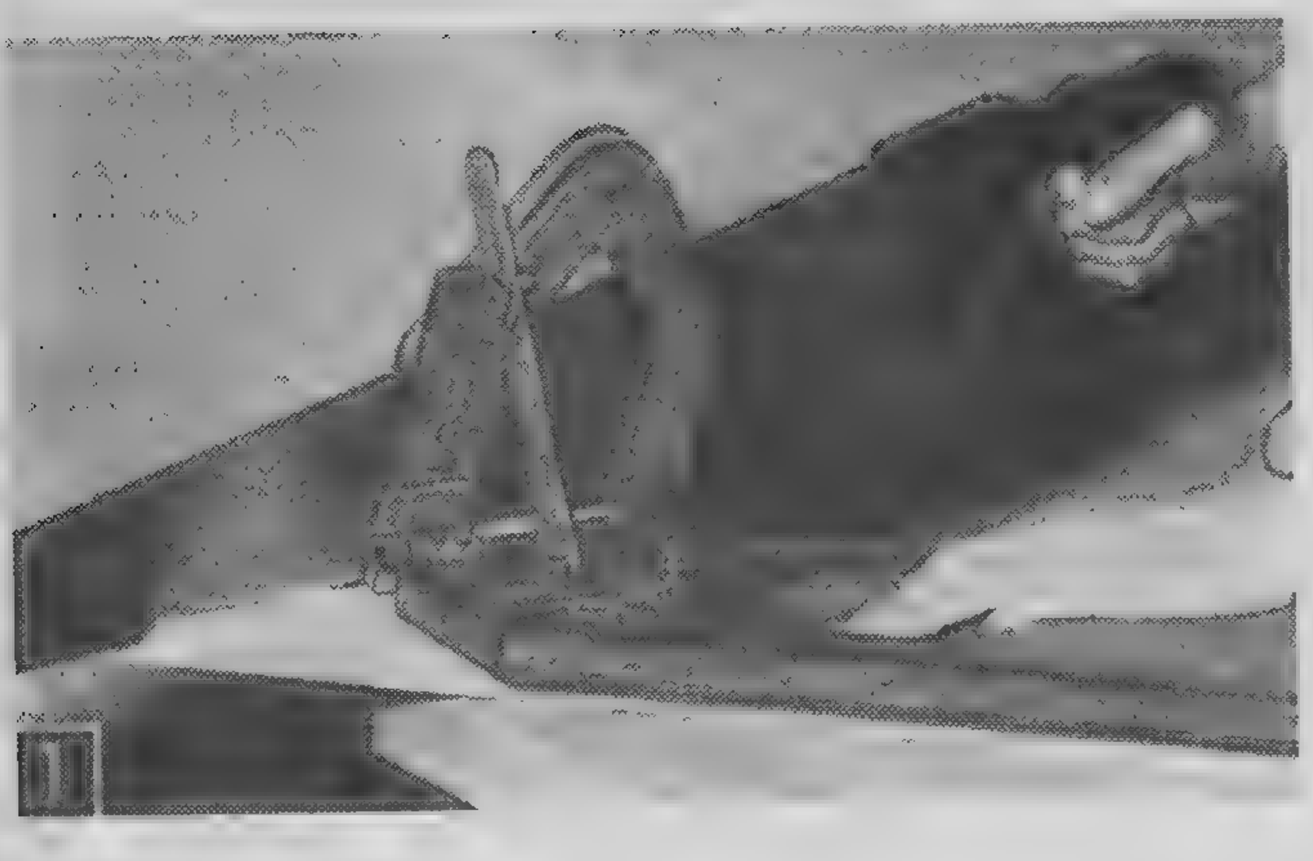
Fig. 16. Replace brushes in brush holders and operate motor with handle off to check brushes. Sparking may continue briefly after assembly, but if excessive sparking continues, reverse brushes or seat them with a soft commutator stone applied briefly to commutator.

You'll want to check the fit of the armature in its bearing plate (Fig. 14). Drop medium machine oil on the shaft at each end of the armature and slide it into the field unit. Use only a slight amount of oil on the commutator end of the shaft; otherwise, oil may get on commutator and brushes. Slip on the fan plate next followed by the bearing plate (Fig. 15). Place the ball-bearing thrust washer (Fig. 3) between the two hardened surface washers on the chuck shaft with a liberal application of grease applied. If there is already sufficient grease of medium consistency in the gear case, it won't be necessary to add grease. Otherwise, clean out the case as indicated above and refill or simply add additional grease.

Before attaching the handle, install brushes and run the motor (Fig. 16). Hold the switch closed and watch for arcing brushes. There may be a tendency for brushes to arc when first assembled, but it should diminish shortly as brushes seat better. However, excessive arcing will damage the commutator, and, if the condition persists, try reversing the positions of the brushes in their holders. Make sure brushes' curved lower surface lines up with curved surface of commutator. A soft commutator stone, pressed lightly against the commutator while the motor is operating, helps to seat the brushes. These special stones can be obtained in electric motor shops or from dealers in such supplies. Use these stones with caution and for only a few seconds at a time.



When brushes and commutator are working smoothly, reassemble handle and switch. To test your reassembled drill, try drilling holes in a piece of scrap steel using a ¼-in. twist drill (Fig. 1-B). A drill in good condition, like ours, should cut through the steel plate without stalling or slowing down much when pressing hard.



Compound

Miter Box

CUT difficult compound angles for shadowbox and picture frames with this unique mitering tool from your own workshop.

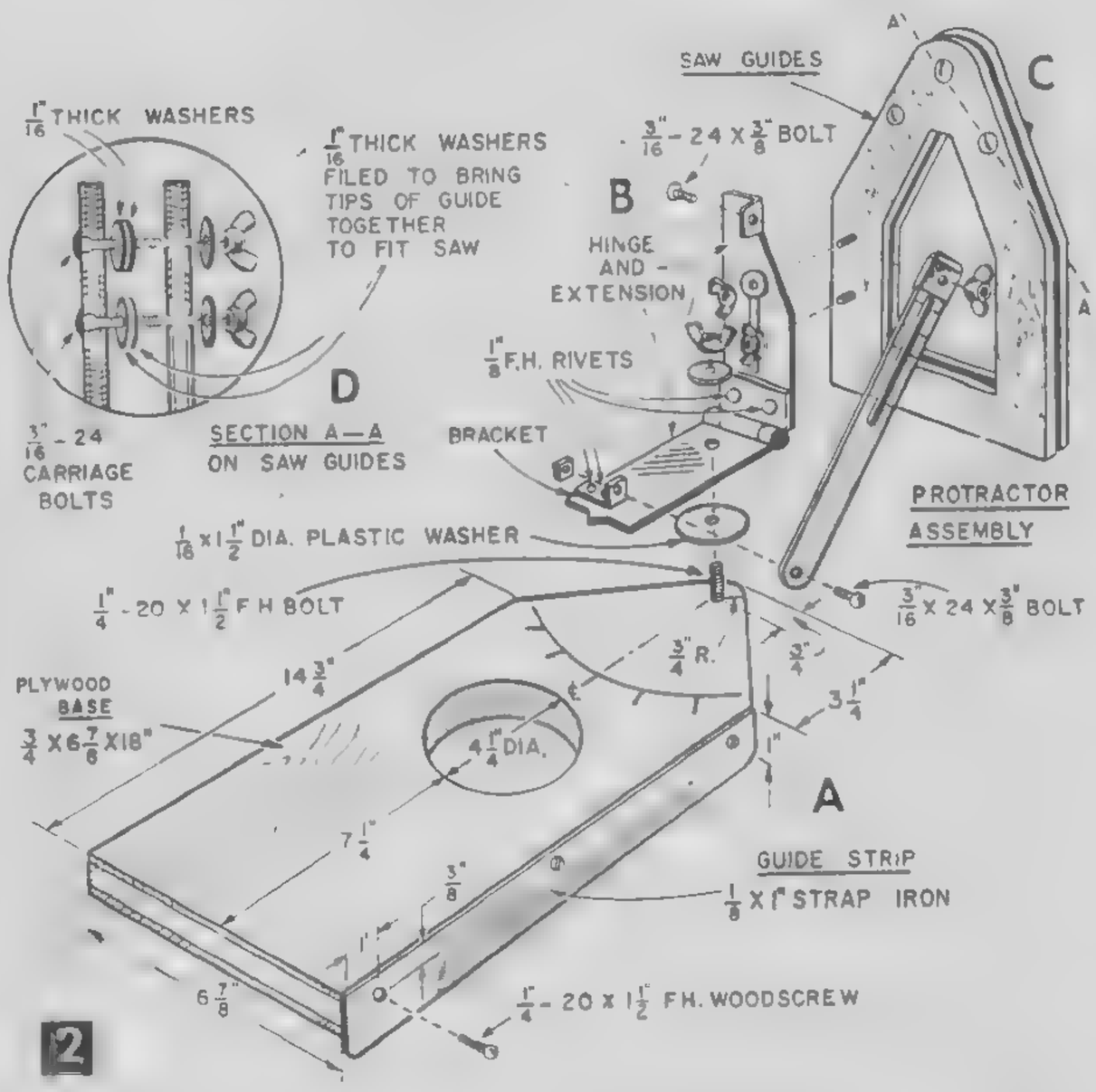
Horizontal angles can be made 45° either way from 90° and the saw guides can be tilted from 20° to vertical, offering any combination of miters and bevels in this range.

Cut the base (Fig. 2A) from ¾-in. plywood and make a 4¼-in. opening for holding the stock being mitered. Drill a 7/32-in. hole to mount the protractor to the base and countersink it deeply on the underside. Thread a ¼-20 x 1½-in. *fh*-bolt through it, making it a tight fit to keep the bolt from turning when its wing nut is loosened. Make the guide strip from a ⅛ x 1 x 14¾-in. piece of scrap iron, smoothing the lower edge and rounding the corners. Drill and countersink three 7/32-in. holes in the guide strip and attach it to the base with #10 x ¾-in. *fh* woodscrews.

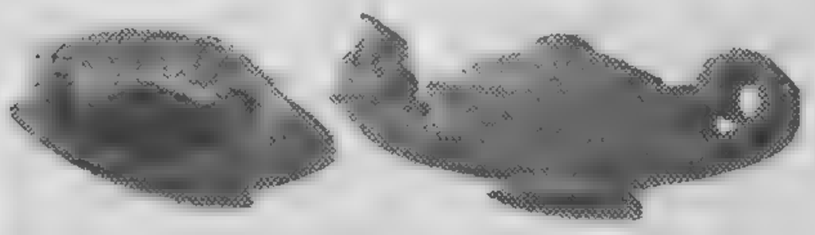
The protractor for setting the angles of the saw guides is made from a ⅛ x 1¾ x 9-in. hinge, cut and drilled as in Fig. 3B. Make the extension, arm and bracket from ⅛-in. strap iron. Cut the adjusting slots in the arm and extension by first drilling ¼-in. holes and finishing with a hacksaw and file. Assemble the hinge, extension and brackets (Fig. 2B) with ⅛ x ⅜-in. soft-iron rivets, countersunk where they meet the saw guides and base. Attach the arm and the 1/64-in. copper angle indicator and fasten the assembly to the base, using a 1½-in. dia. washer cut from 1/16-in. plastic as a bearing.

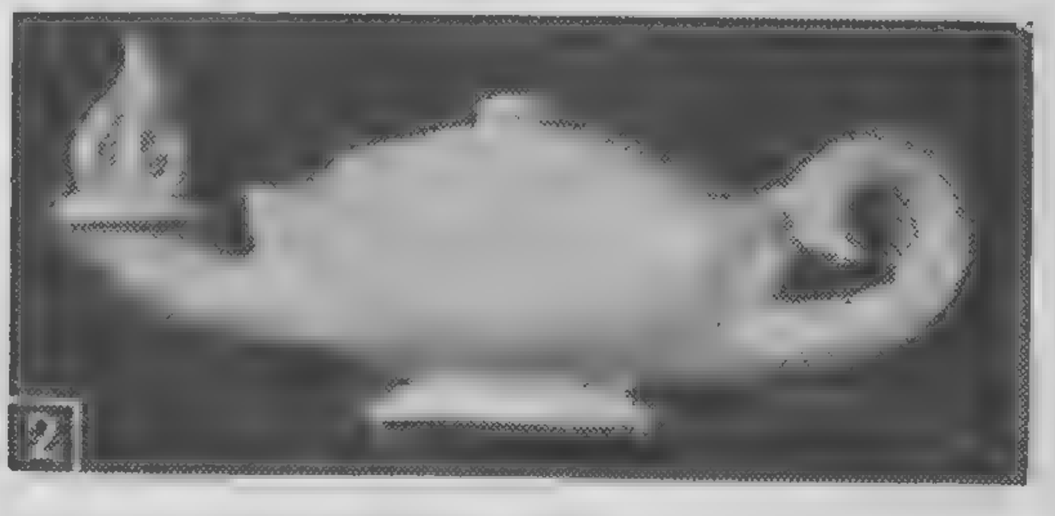
Cut the saw guides (Fig. 3A) from ⅜-in. plywood, drilling holes for the three #24 x 3/16 x 1¼-in. carriage bolts. Drill and countersink two 3/16-in. holes in one guide, and fasten it to the hinge extension with #24 x 3/16-in. *fh* bolts, washers and wing nuts. Now assemble the guides with two 1/16-in. washers on the upper bolt (Fig. 2D). Adjust the space on the two lower bolts by using thinner washers so the lower edges are a close fit on the saw blade. Finally, seal coat the plywood parts.

To use, approximate the angles and test on scrap wood. Check the cut with a gage and scribe marks on the base and arm (Fig. 2).



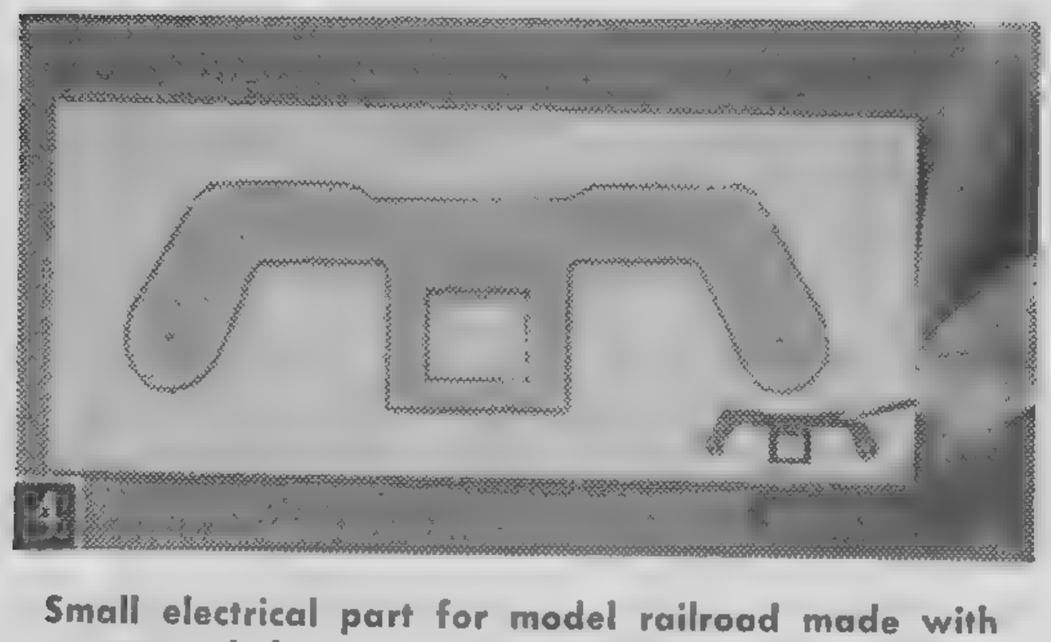
Above, comparison of Indian head master and finished birch carving.





Left, pantograph being used to carve head from master pattern to one-half actual size. Right below, Aladdin's lamp master pattern, and above it, ¼-size ebony wood brooch and ½-size wood carving made by the pantograph from the master carving.

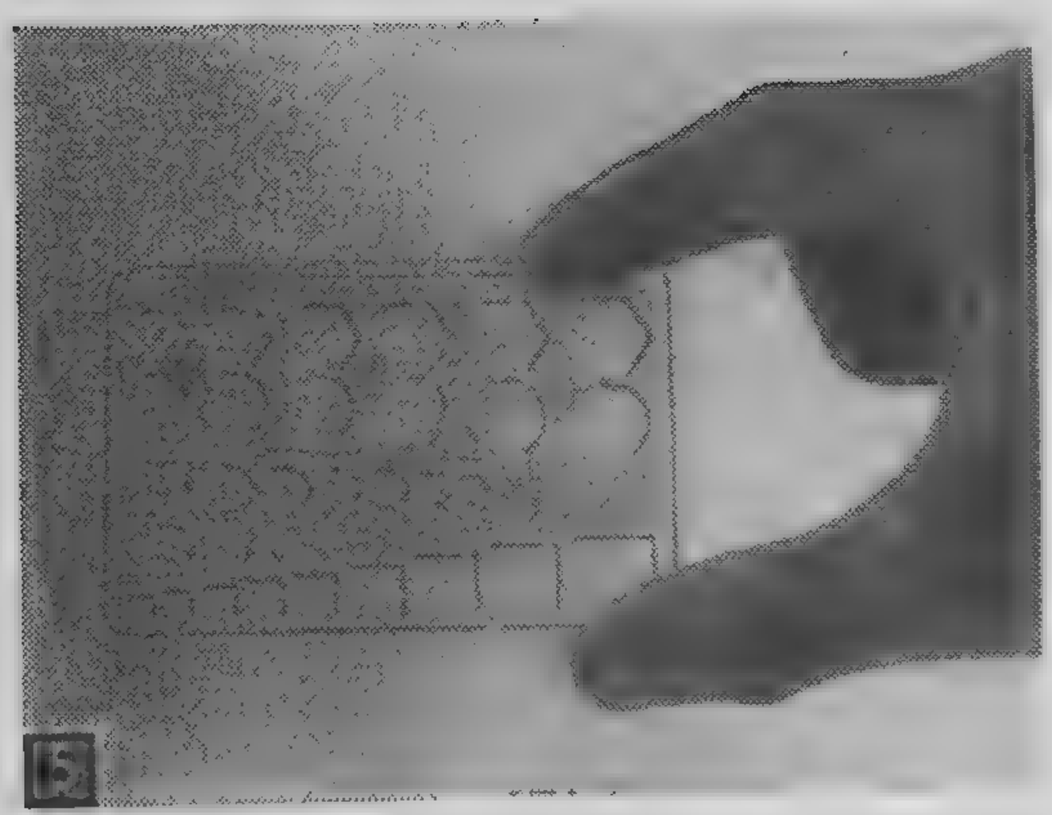
Making and Using a Carving Pantograph



Small electrical part for model railroad made with pantograph from 4 to 1 cardboard pasteup. Making parts this way frequently saves industry the cost of expensive dies until final designs are approved.

YOU can make fine reduction carvings from almost any three-dimensional object within the moving limits of the comparatively simple carving pantograph seen in Fig. 1.

This inexpensive unit can be built from scratch or assembled from pre-cut, finished parts furnished in a $12.95 kit (see construction details on page 154). You can make templates, brass molds for plastic injection molding, name plates, and form dies for small ornamental metal parts. Jewelers can engrave tiny lettering and signatures. HO-gage model railroaders can make detailed models four times gage size, then accurately pantograph-carve them down to size as in Fig. 4.



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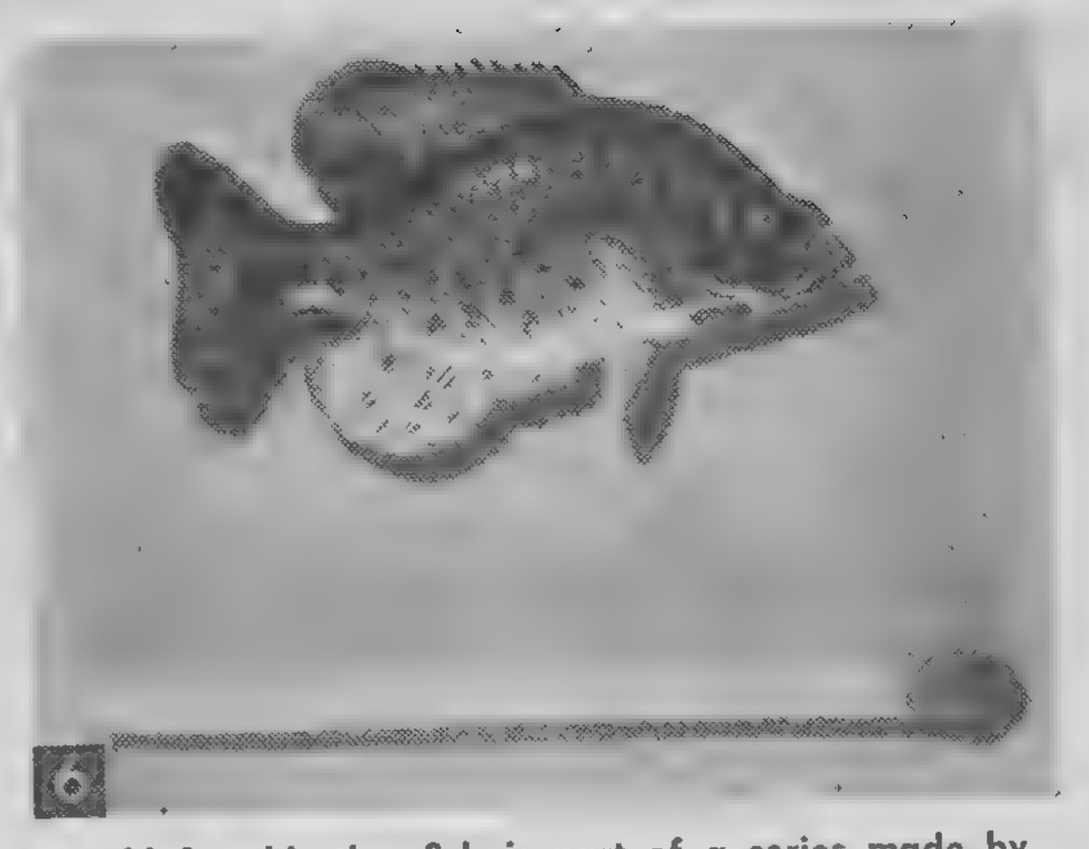
Draftman's template reduced to ½ the original size for minute work.



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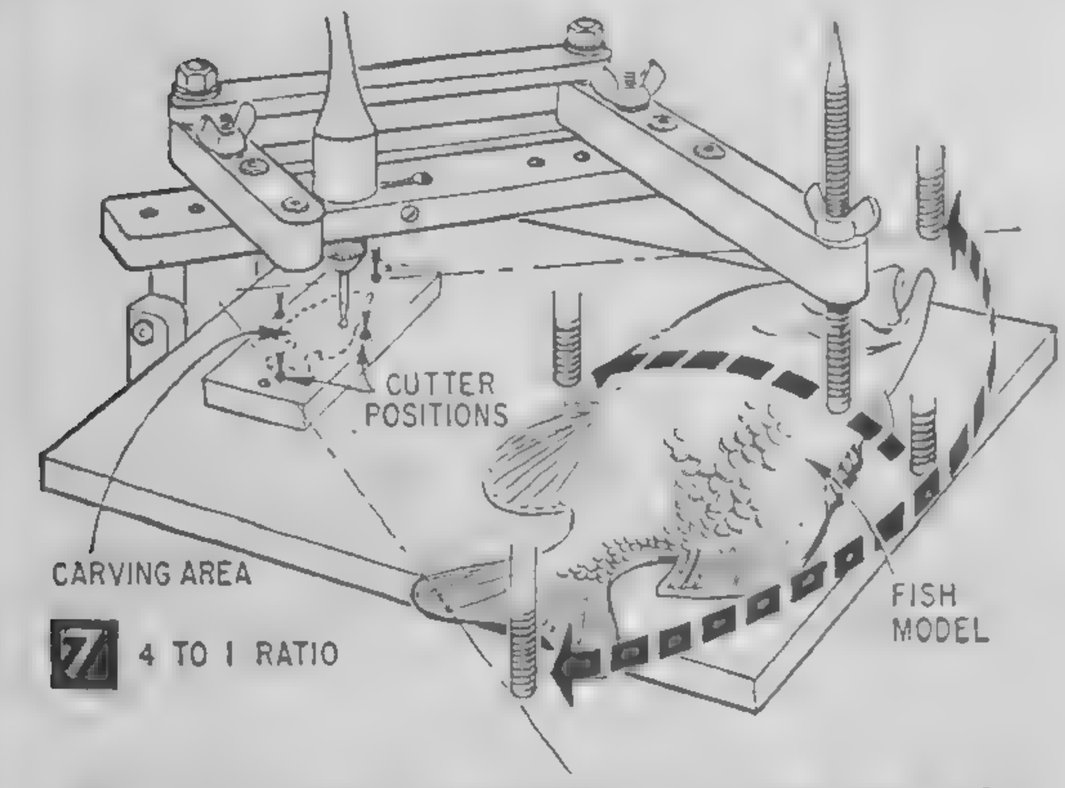
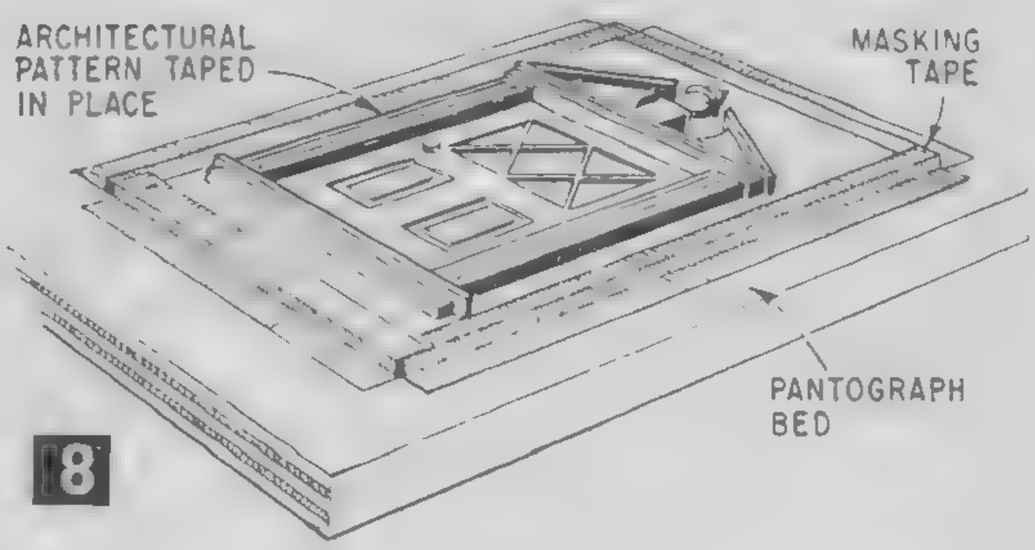
Mold for this tiny fish is part of a series made by Wildlife Miniatures of Chicago, from large plaster casting of original model. The plastic miniatures are hand painted in full color.



7 4 TO 1 RATIO

Place the work on the bed. Then, with the stylus, test to be sure entire project will fit on material. Fasten it in place with screws, screw clamps or tape.



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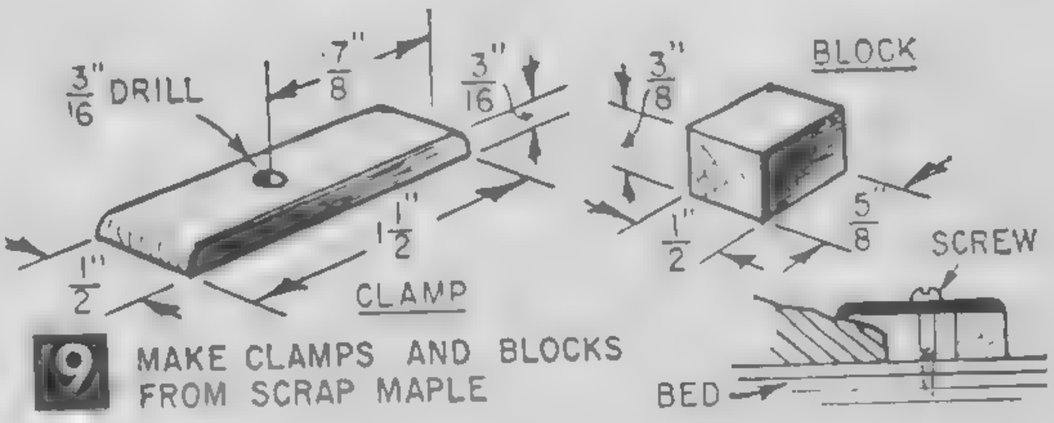


9 MAKE CLAMPS AND BLOCKS FROM SCRAP MAPLE

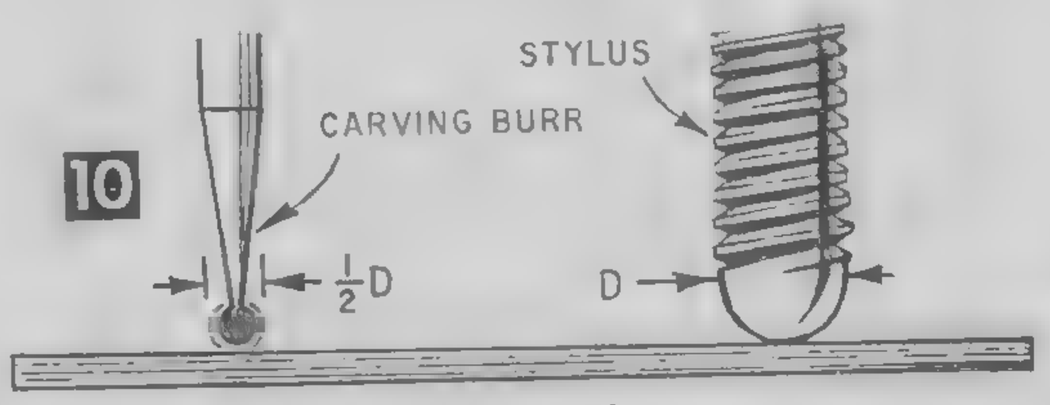
Two methods of holding work and patterns in place. A third way is to screw through a scrap portion of the unit to the bed.

This tool is ideal for linoleum block carving, for block printing plates, or for carving miniatures of animals and flower plaques for jewelry. For example, you can easily carve in a small bit of rare wood a beautiful brooch, one-third the size of the original model. Then, using the finished carving as a pattern without resetting the pantograph, you can reduce the same carving to one-sixth the original—or just the right size for matching earrings. Ordinary shop tools (Fig. 17) make ideal models for men's tie-clips and cuff links.

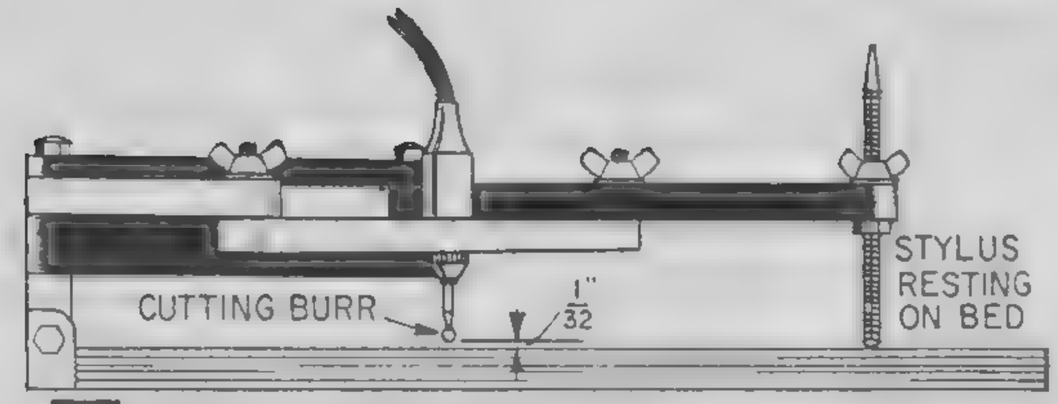
How to Use a Pantograph. When setting up your work for carving, allow about a half-inch of extra material on all sides to be cut away as scrap. First locate the pattern on the bed as indicated in Fig. 7, then temporarily spot the material to be carved in position. Move the stylus to the outside edges of the pattern, checking to be sure the material will be large enough to cover these points.

The patterns may be taped, clamped or screwed directly to the pantograph bed. For simple flat work, ordinary masking tape usually works well (Fig. 8). For irregular objects, make simple clamp blocks as in Figs. 1 and 9. If your pattern has plenty of scrap area, it may be easier to screw directly through the pattern into the bed. Fasten the material to be carved to the bed similarly, making sure that none of the tape, screws or clamps will be in the immediate vicinity of the carving head.

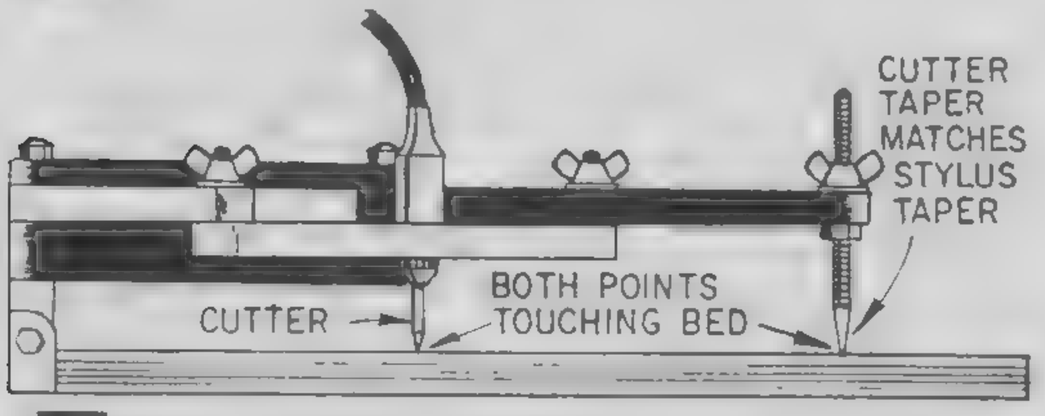
If you are carving with a round-headed burr, choose a burr that is ½, ⅓ or ¼ the size of the round end of the stylus. For rough



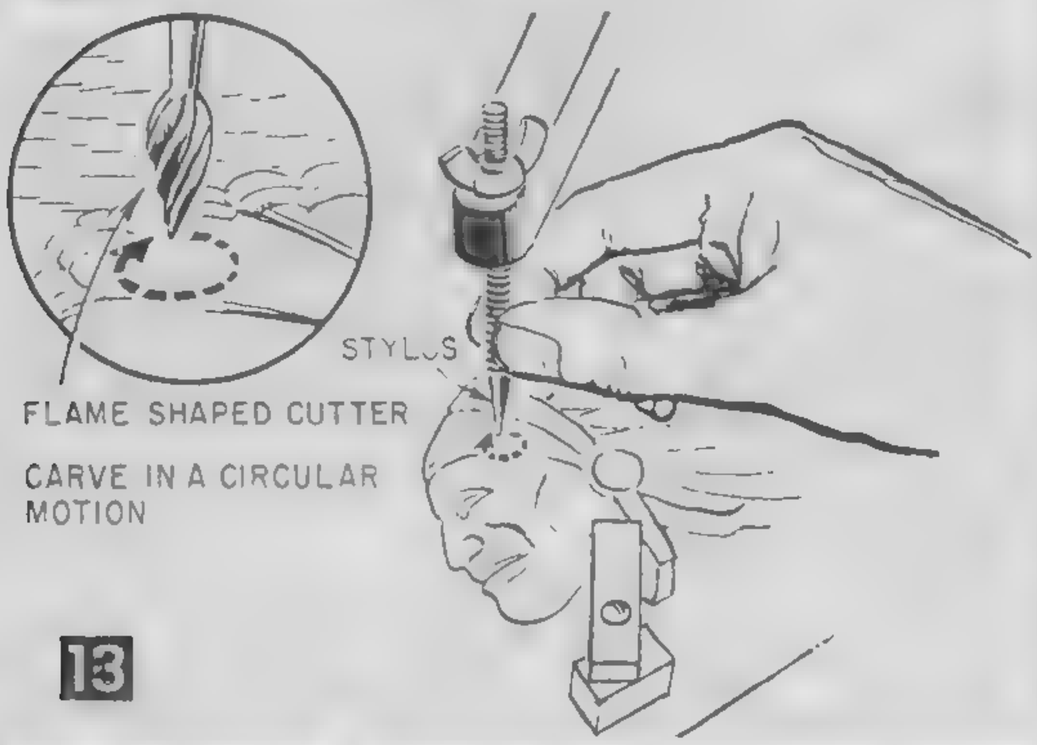
10 2 TO 1 RATIO (ROUGH CUT)



11 SETUP FOR ROUGH CUT



12 SETUP FOR FINAL CARVING



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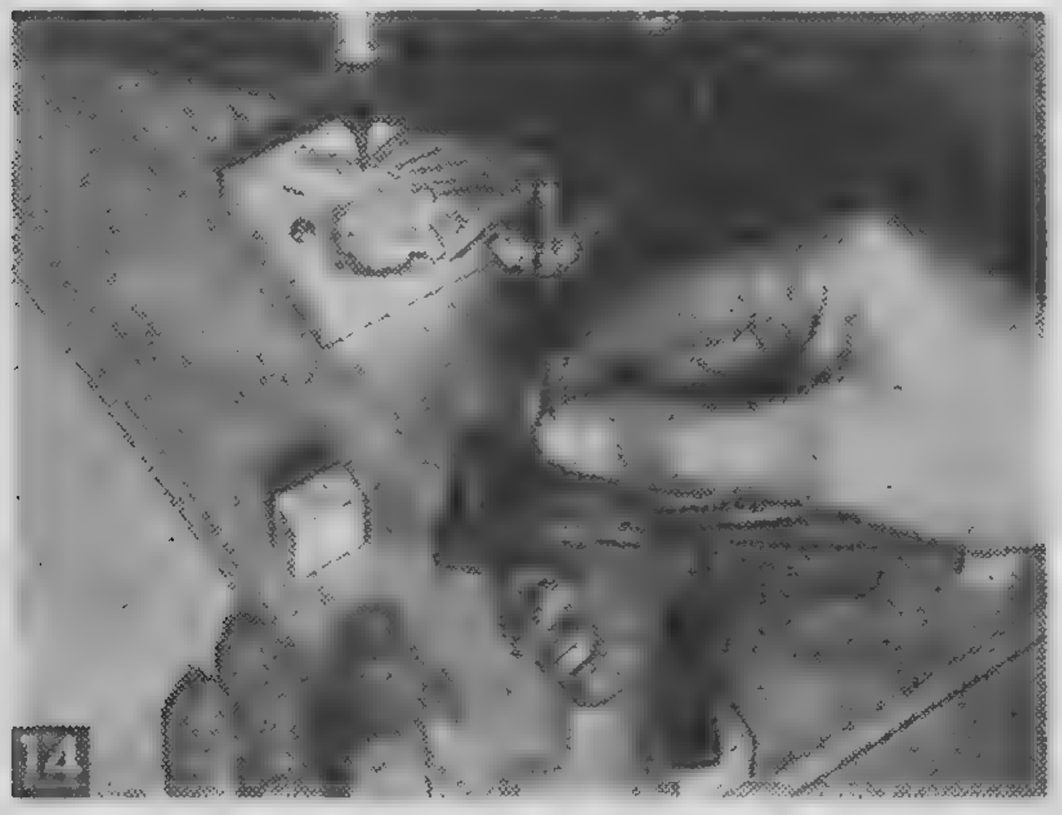

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Loosen one clamp at a time and carve away excess material in that area. Then reclamp, loosen the next clamp and repeat the procedure.

cuts the burr should be even smaller than the exact ratio of the reduction you plan to make (Fig. 10). If you use a flame-shaped or tapered cutting tool, then you'll need a tapered stylus point to match (Fig. 13).

Insert the stylus in the pantograph and set to a depth that will allow the arms to be approximately level. Then insert the cutting burr and set it so that it will be about 1/32 in. above the pantograph bed while the stylus is resting on the bed (Fig. 11).

You are now ready to make the first rough cut in the material from the pattern. With the pattern and material securely clamped to the bed, start carving on the high points and work in a rotary cutting motion with the stylus over the pattern. This will allow the cutter to clear away any shavings after each bite (Fig. 13). Work over the entire pattern, including areas around but not under the clamps, which are not removed when making the rough cuts.

For the Finish Cut, put in your sharpest cutting tool and reset the depth so that the cutting tool will just touch the bed while the

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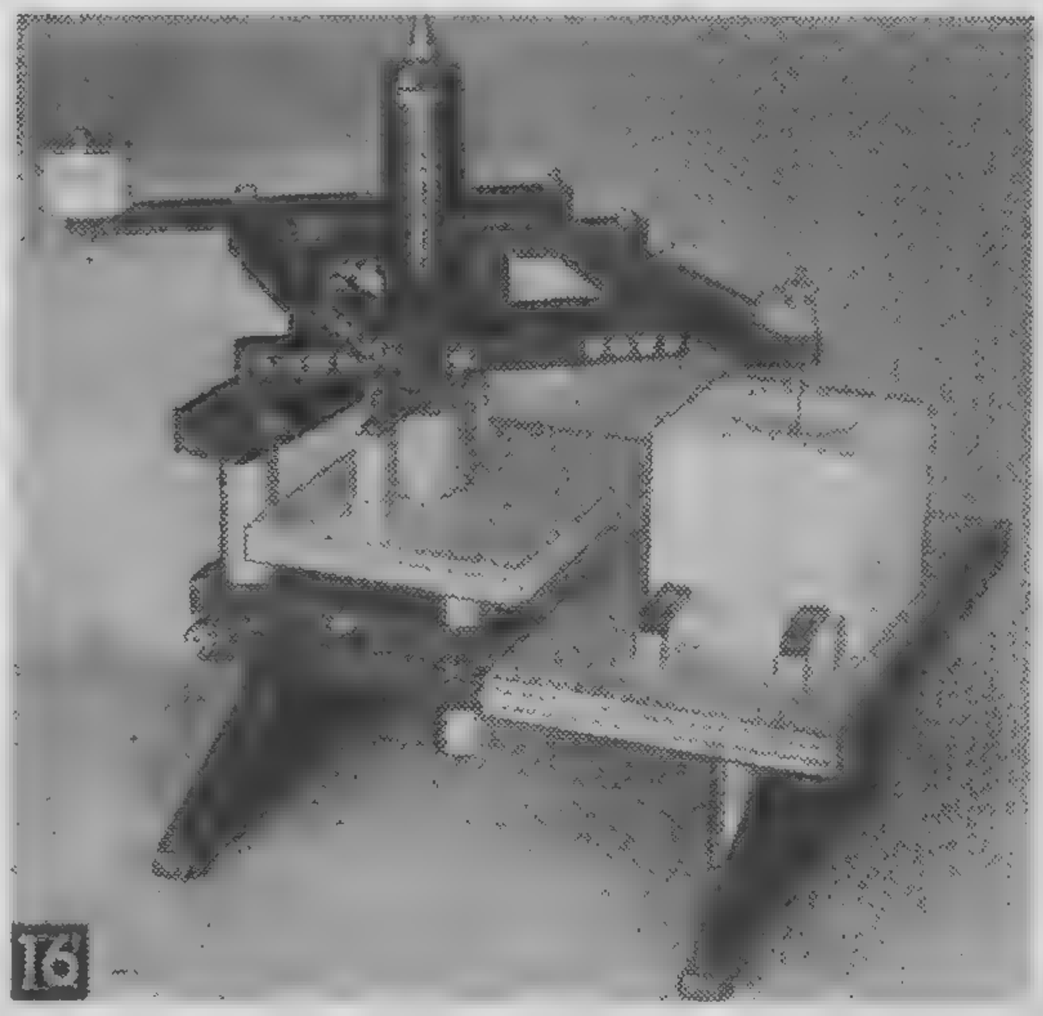
Finished Indian head carving ready for light touch-up sanding and finishing.



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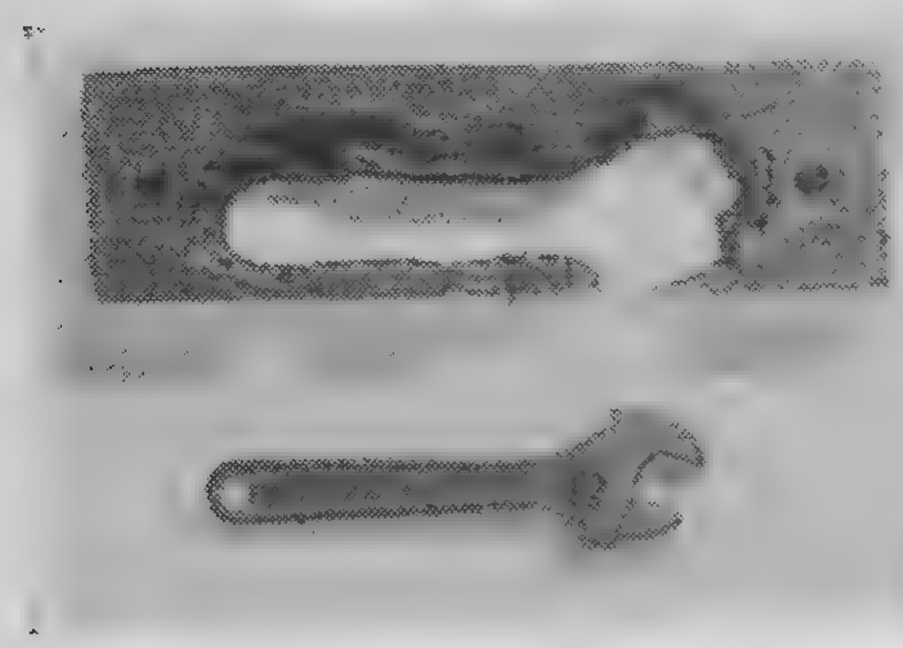
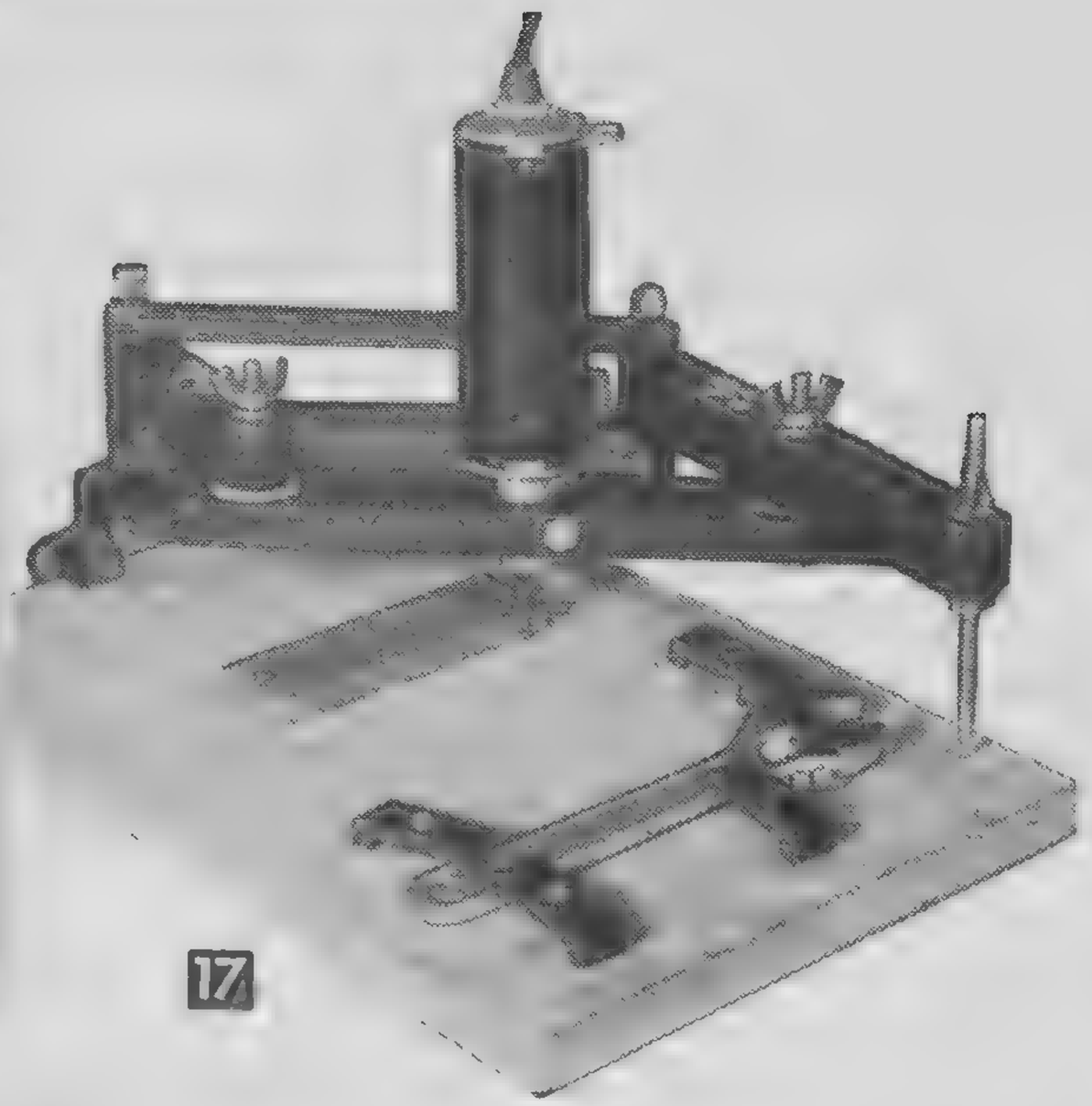
Mold of the outside tall bottle cap being made on a professional-size Bench Craft pantograph from a deep plaster pattern. Note the two adjustable beds.





Pantograph set up to carve out a wrench pattern one-third size of wrench clamped on the bed. Inset shows smooth-finished piece cut out of small hardwood block by portable electric grinder held in the motor arm.

stylus is resting on the bed (Fig. 12). Again carefully go over the original pattern with the stylus in a circular motion, being sure to carve away every bit of scrap. Then remove one clamp at a time and carve away the material in that area (Fig. 14). Replace the clamp and move to the next one, and so on. Finally carve around the edge to free the finished reproduction. When you are through, you will have an accurate reproduction of the original pattern ready for slight sanding and painting (Fig. 15).

For larger projects that are too thick for a single flat bed, you may need to build a two-level bed similar to the Bench-Craft professional model shown in Fig. 16. The two-level beds will allow you to obtain at least double the height with much less distortion due to the tool pivoting about the hinge-blocks.

Construction Details. To build this carving pantograph accurately from scratch, you will need to have access to a good circular saw and drill press, a sharp letter D-size drill, a left-hand ¼-in. spiral reamer, a 15/32-in. counterbore with ¼-in. pilot, and a circle cutter with a ¼-in. pilot drill.

If you do not have this power equipment and special tools, you can dispense with the need for them in this project by ordering the parts pre-cut and finished in kit form from Bench-Craft, Dept. HW, Rolling Meadows, Ill. ($12.95 postpaid).

The kit includes fully-machined rock maple arms protected with a warp-resistant ebony finish, all hardware washers, the stylus and assembly sheet, and notes on processing the bearing. All bearings are ready for lubrication and assembly.

Not included, of course, are the plywood bed (which you can make from scrap), the powered hand grinder and flexible shaft.

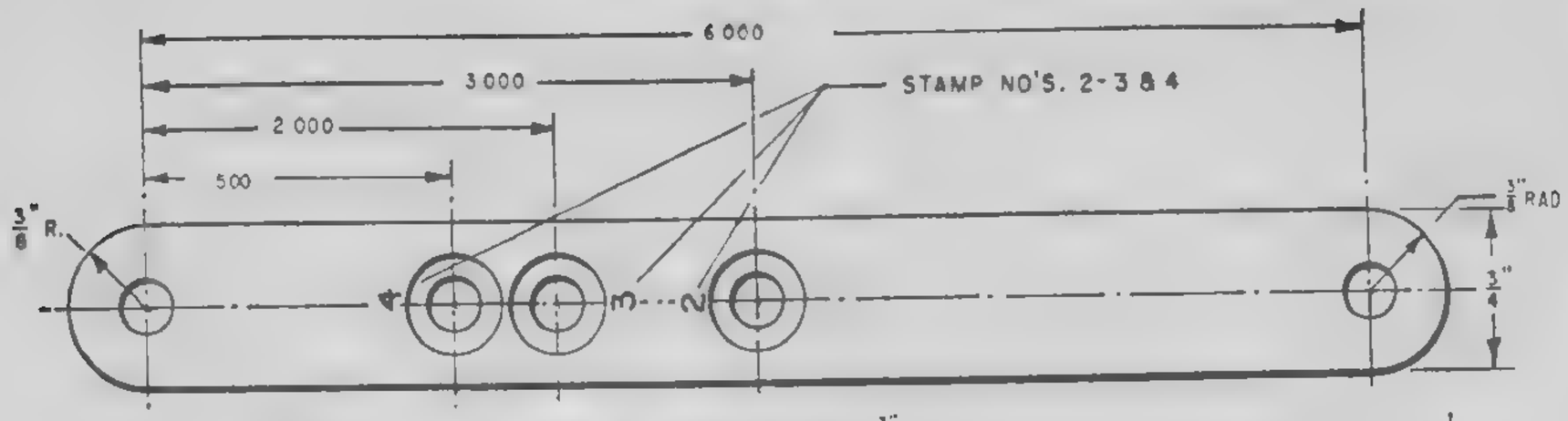
Make the Bed (Fig. 18) from ¾-in. fir plywood. Since it is a work surface to which you will screw-fasten many projects, don't finish or polish it.

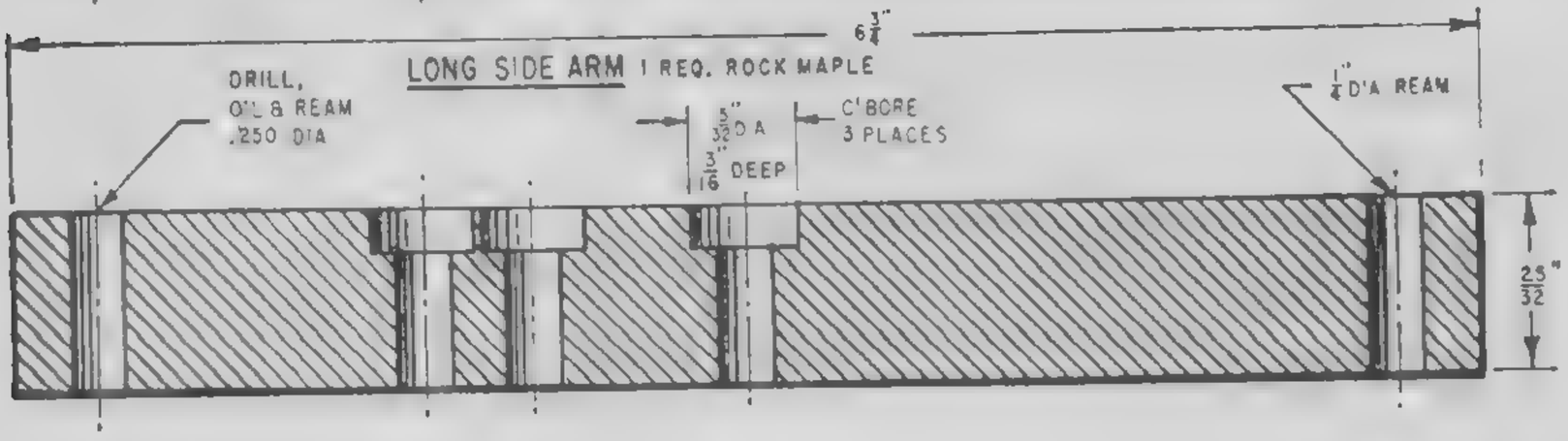
From rock maple (required for accuracy) carefully saw the various arms and brackets to shape as in Figs. 18 and 19. Then carefully drill and counterbore the holes shown, starting with the pivot block.

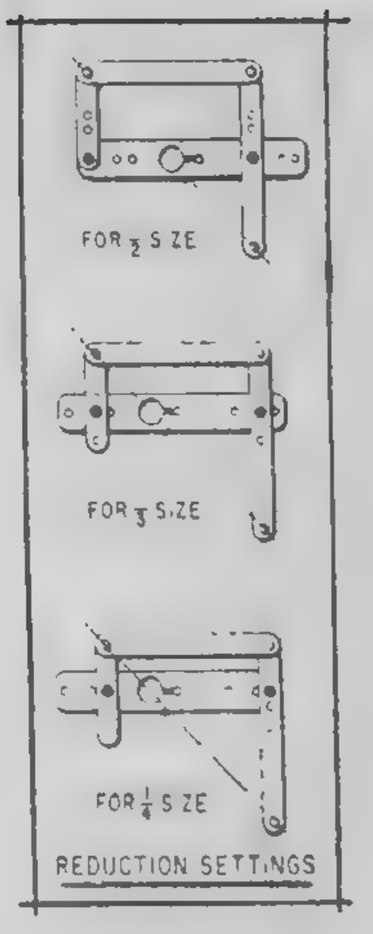
Drilling the arms requires the utmost accuracy. For best results, lay out a template on a piece of ⅛ x ¾-in. steel or aluminum bar stock for the locations of the various holes in individual arms. Clamp the template in place on one arm, drill the end hole with the letter D drill, and insert a ¼-20 bolt. Drill the hole in the opposite end and insert another ¼-20 bolt. Then drill the rest of the holes in that arm. Drill the various holes in the other arms similarly, using the template for accuracy.

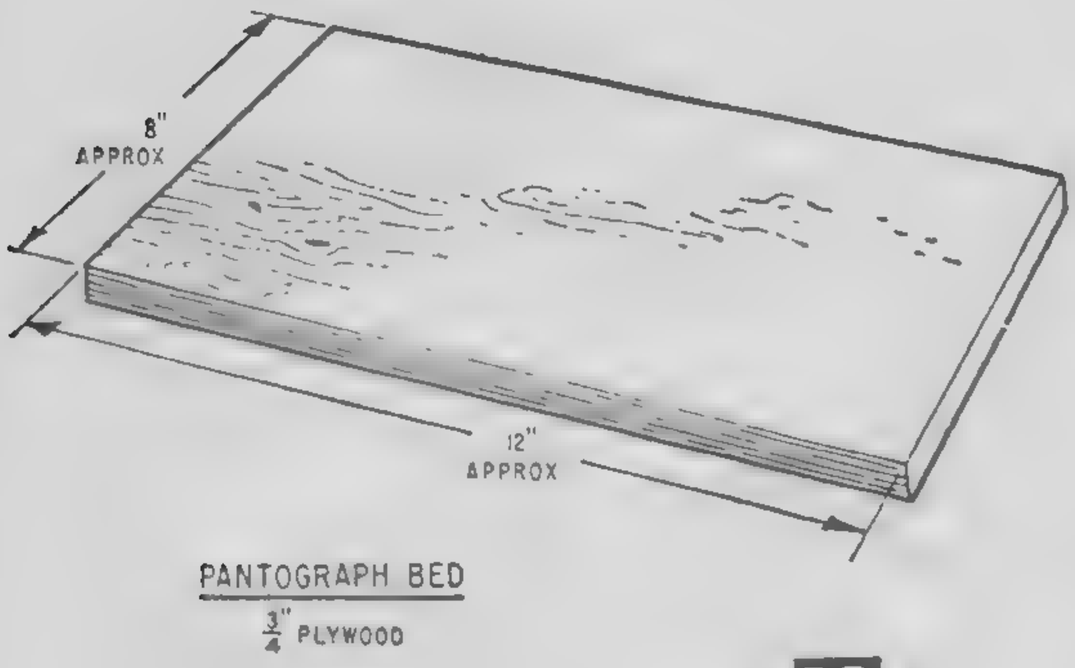
MATERIALS LIST—CARVING PANTOGRAPH

No. Req'd	Size and Description
2	1⅛ O.D. x 17/64 I.D. x .060 thick 1" dia. nylon washer
10	9/16 O.D. x 17/16 I.D. x .060 thick nylon washer
2	9/16 O.D. x 9/32 I.D. x 3/64 thick steel washer
3	¼" A.S.A. medium lock washer
3	¼" 20 N.C. lock nut (plastic insert)
7	¼" 20 N.C. standard hex nut
3	¼" 20 N.C. standard wing nut
1	8-32 N.C. standard hex nut
2	¼" 20 x 1¾" N.C. hex head cap screw
1	¼" 20 x 2" N.C. hex head cap screw
1	¼" 20 x 2¾" N.C. hex head cap screw
1	¼" 20 x 3" N. C. hex head cap screw
1	8-32 x 1¼" *rh* machine screw
2	#8 x 1¼" *rh* wood screw
1	¼"-20 x 4" threaded rod
1	1 x 6 x 14" clear rock maple—planed two sides to ¾" thick
1	⅝ x 8 x 12" fir plywood—good one side
	Cut clamps and blocks from scrap maple as needed

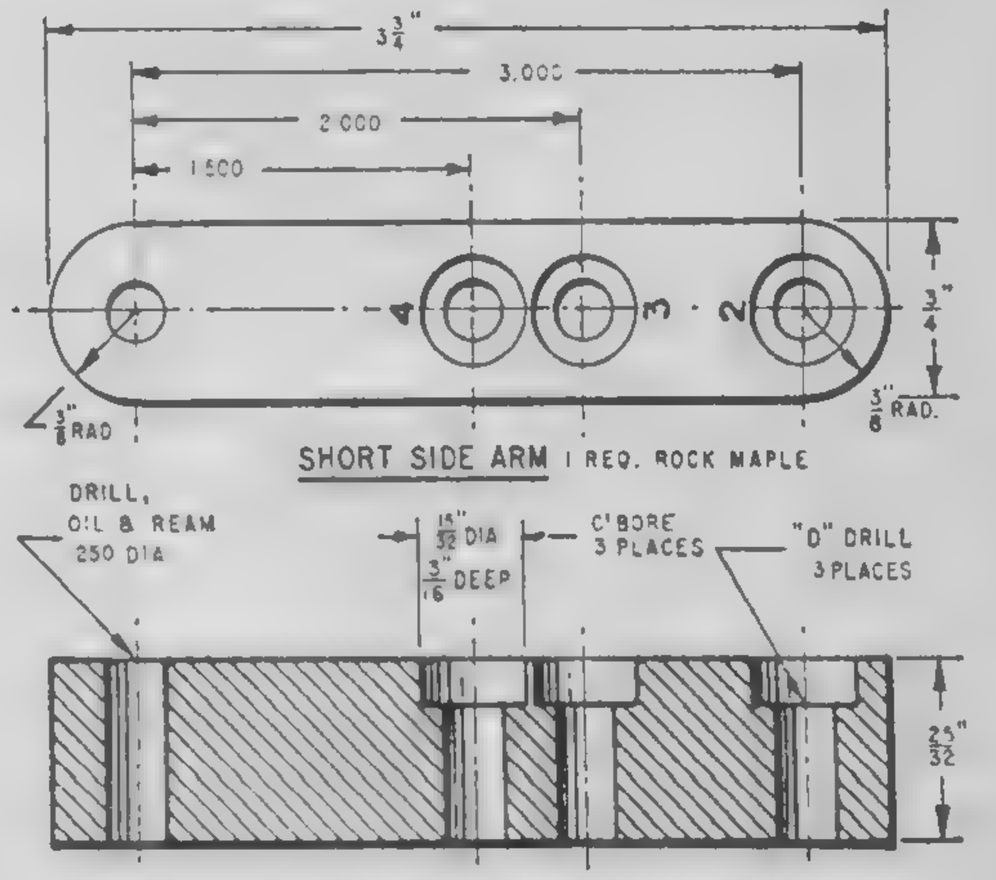








PANTOGRAPH BED
3/4" PLYWOOD



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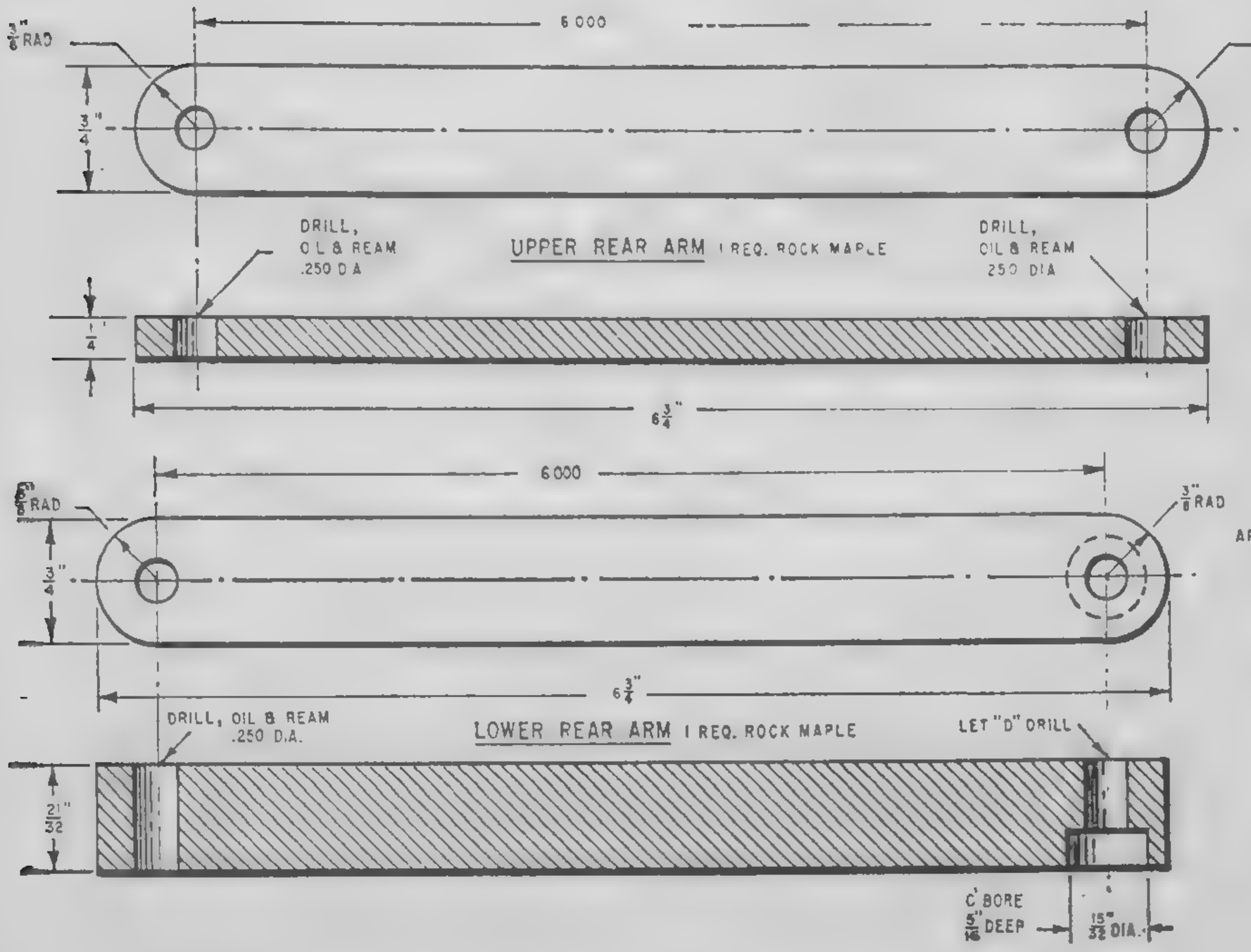
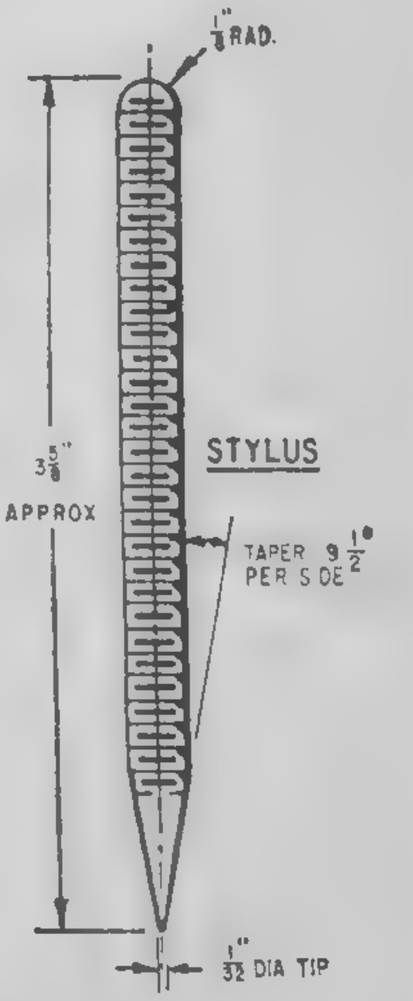
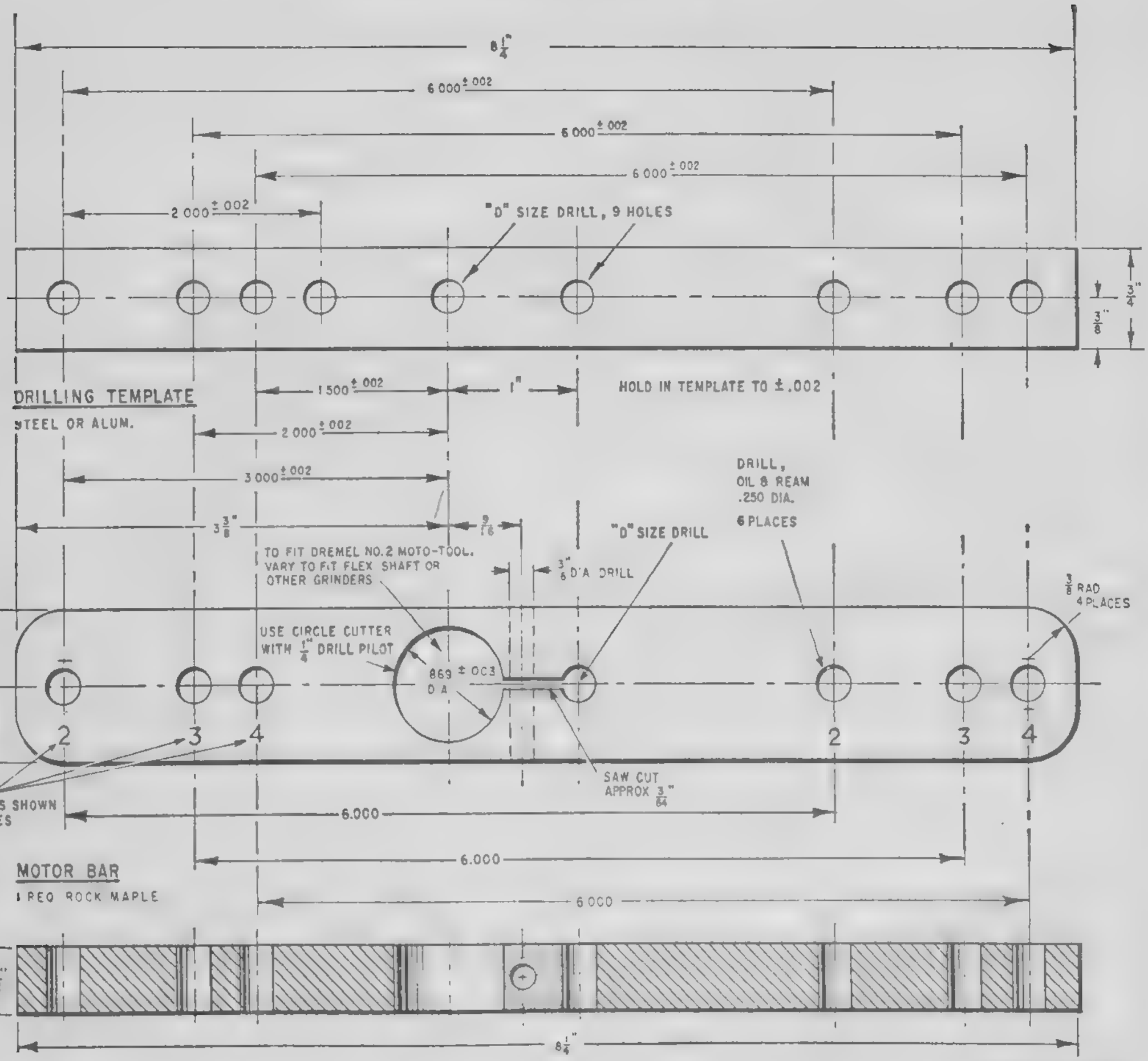
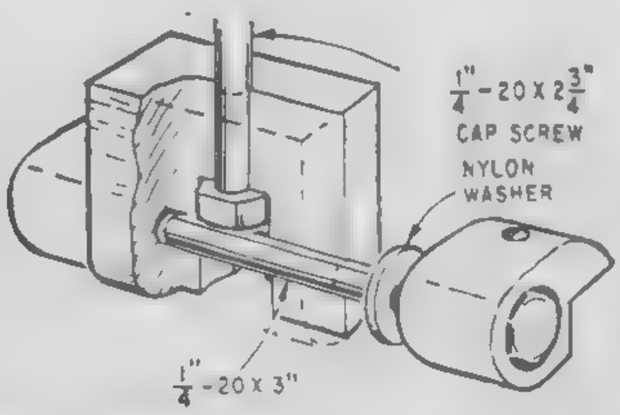




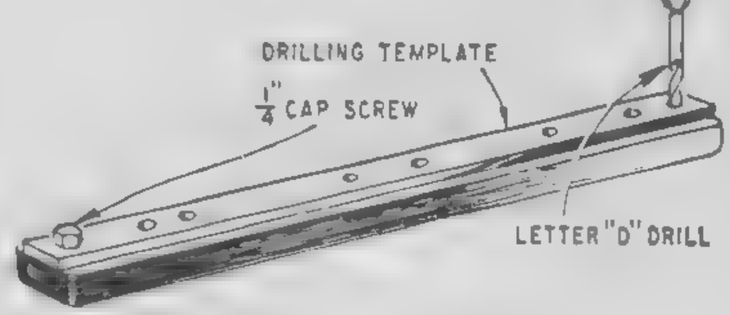


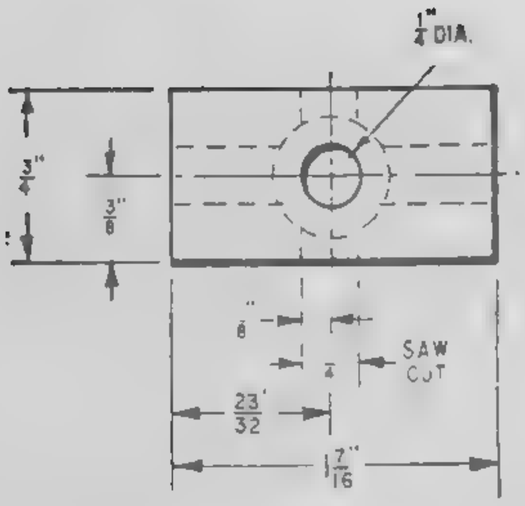
DRILLING DETAIL

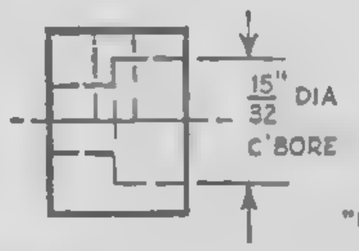
19



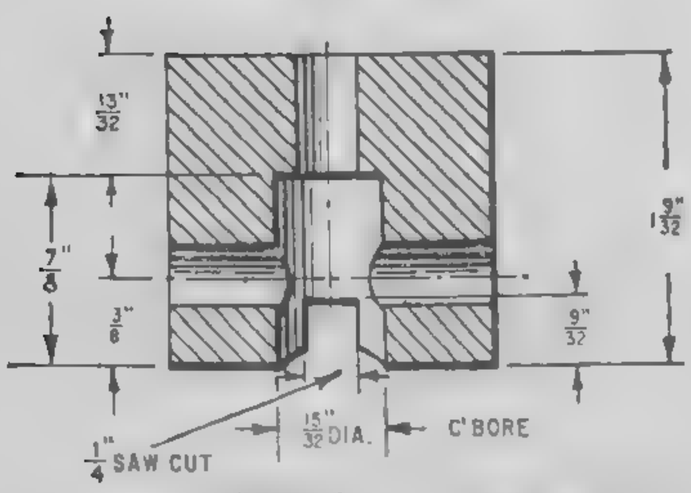
HINGE CUTAWAY DETAIL

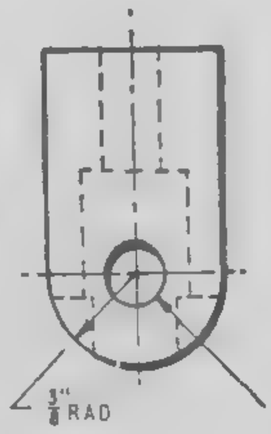


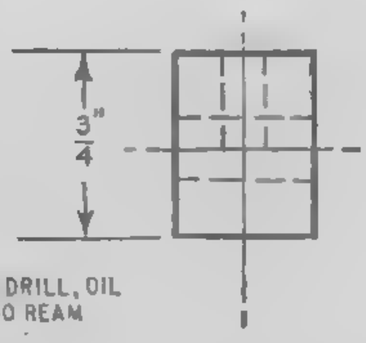


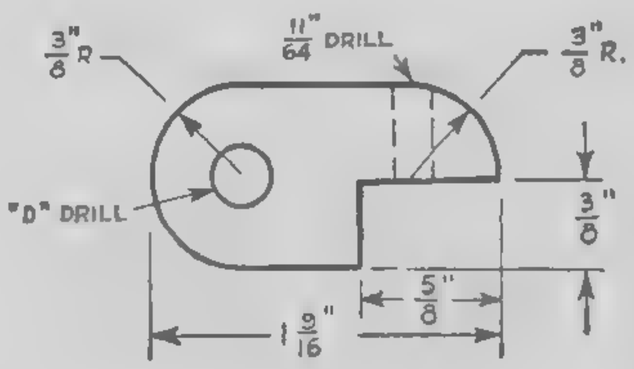


ANCHOR BLOCKS
2 REQ. (ROCK MAPLE)



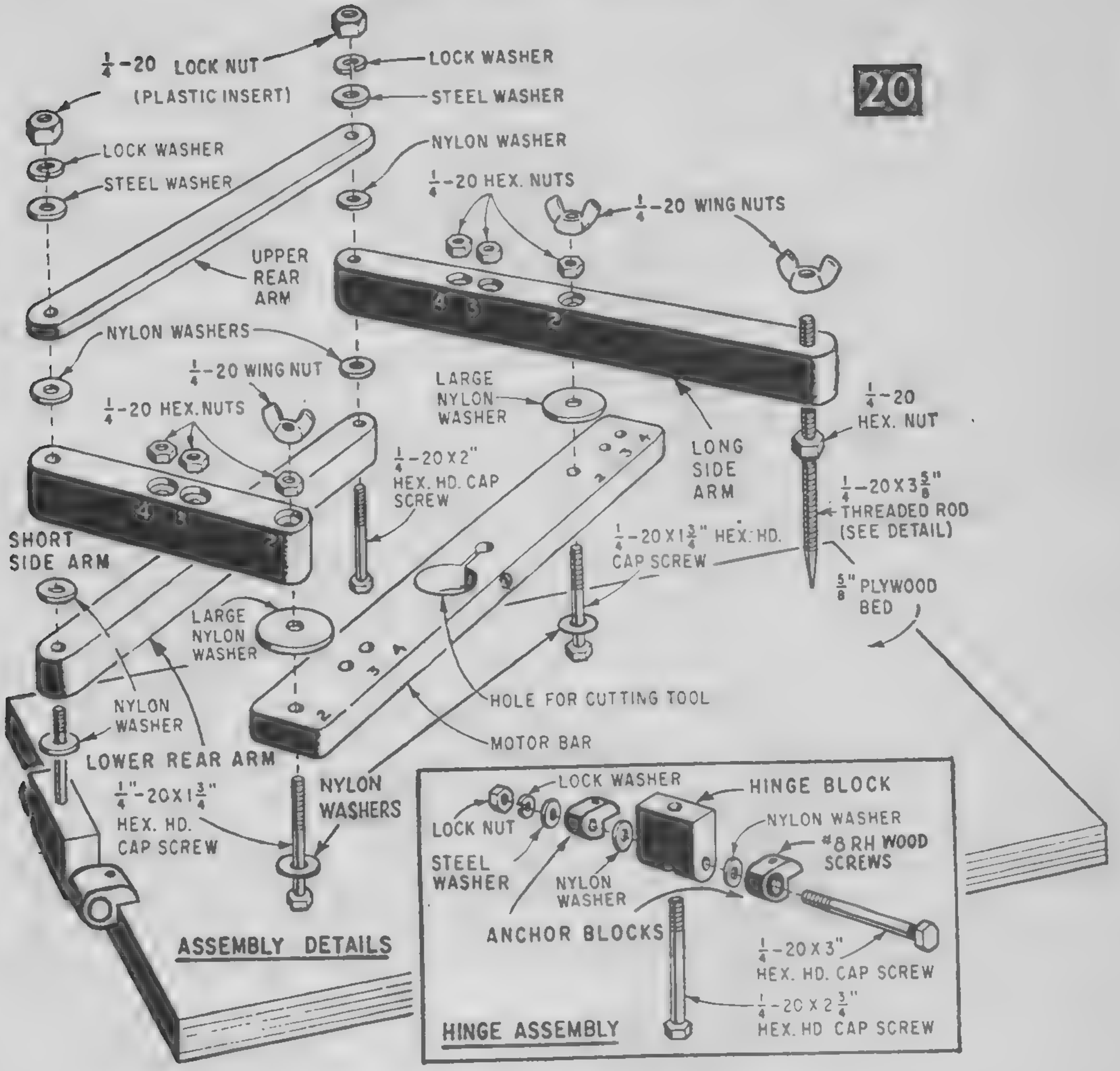






HINGE BLOCK 1 REQ. (ROCK MAPLE)

20



This pantograph can be adapted to almost any flexible shaft such as Foredom or small portable electric hand grinder with a straight shank such as Dremel, with an *rpm* ranging between 7,500 and 27,000. Just adjust the large hole in the tool-holding motor bar for a snug fit on the tool you plan to use. By cutting a slot to a smaller hole in the motor bar as in Fig. 19 and using a nut and bolt, the carving tool can be clamped securely in this bar.

Swab the bearing holes in the arms with SAE 20 oil, then ream all bearing holes with the left-hand, ¼-in. spiral reamer. Re-oil the reamed holes and allow to stand for two days. Repeat this process three times. This will saturate each bearing with oil and give satisfactory bearings for accurate carving.

Insert all of the ¼-in. bolts and nuts that must be press-fitted into the arms. To seat the parts, tap lightly with a small hammer. Re-swab holes heavily with oil and complete assembly except for the motor bar. Add a drop of oil on each nylon washer at assembly.

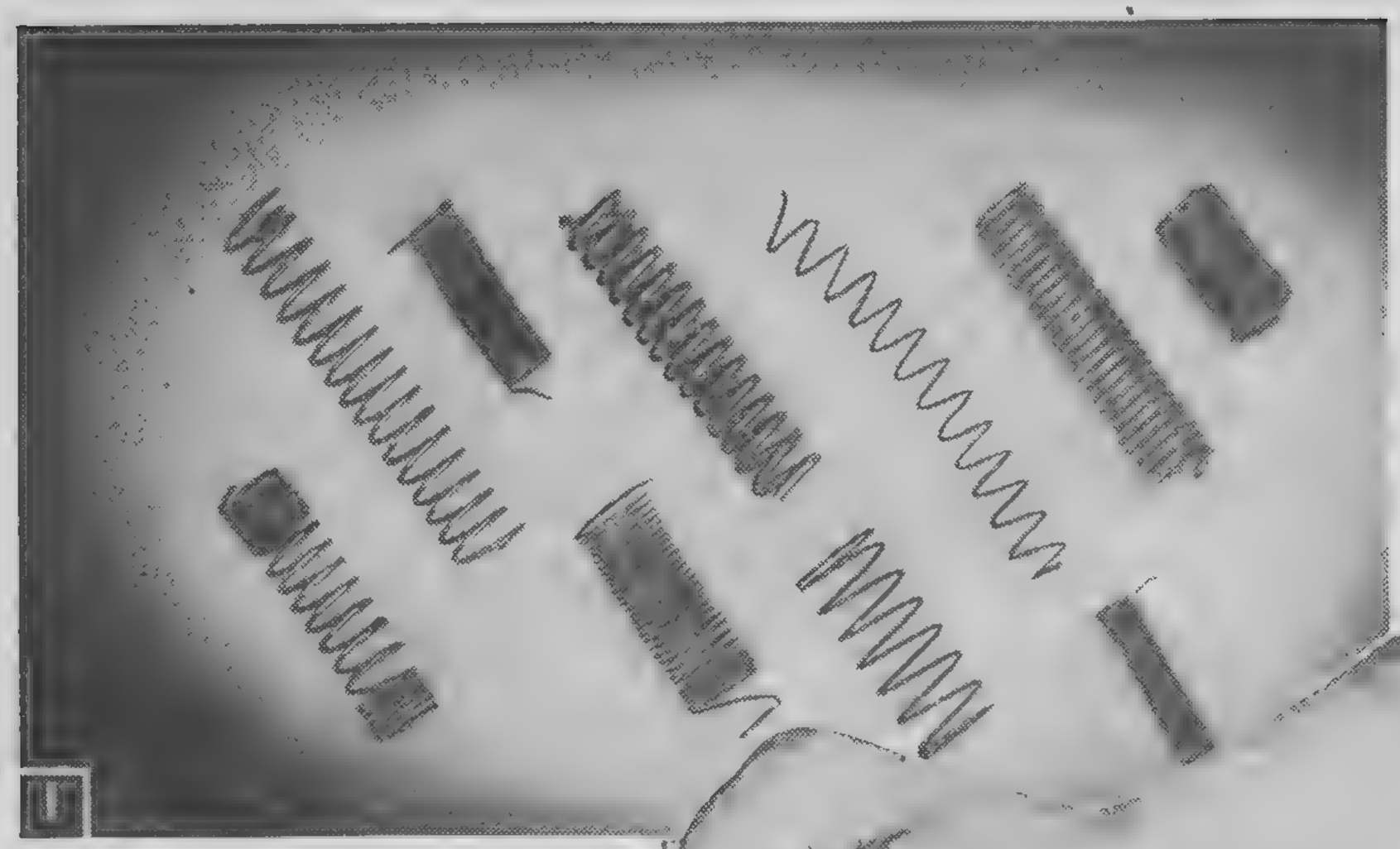
Adjusting the Arms. Starting with the hinge, adjust bolt so hinge will work snugly without sticking. Carefully adjust bolts in each arm individually so that the arms work snugly without binding. If arms are too tight, they will not move; if too loose, they will cause sloppy work.

After the arms are adjusted they should not require readjustment for various reduction settings. Now you can attach the motor bar and make final adjustments at this bar only.

Make the Stylus from ¼-20 threaded rod, tapering one end for a fine point cutter and rounding the other end for ball-shaped cutters.

If nylon washers and lock nuts are not available, you can obtain a complete set of 11 washers, three nuts and a tracing stylus by sending $2 to Bench-Craft, Dept. HW, Rolling Meadows, Ill.

Add the flexible shaft and stylus, and you are ready to go to work.



Left, a few typical examples of the various compression and extension springs that can be wound on this spring winder.

Below, winding an extension spring. Spring winder is held in bench vise so that both hands are free to operate machine.

Making Your Own Springs

YOU can eliminate, once and for all, the problem of quickly locating a small spring of just the right size and type for the job at hand by making this spring winder. The winder plus 3 or 4 coils of spring wire of various wire gage sizes will enable you to wind either right or left hand compression or extension springs up to 5/16 in. diameter as in Fig. 1. Spring coil spacing of 1/8 in. is possible for compression springs, and the length of the springs you can make is limited only by the length that you make the mandrels on which the springs are wound.

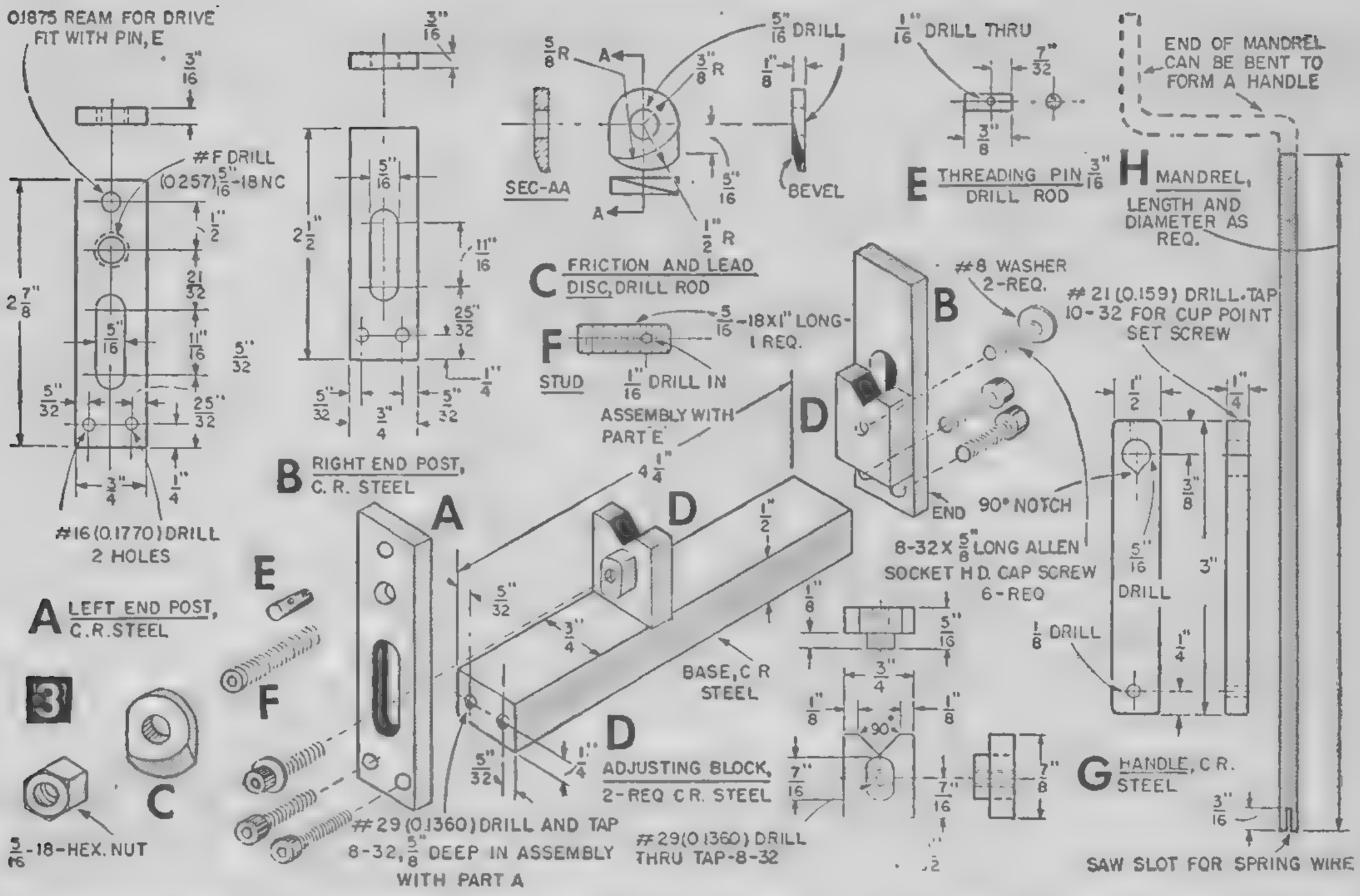
Make all of the parts from the detail drawings in Fig. 3 first. When assembling the parts, the 1/16 in. holes in the threading pin and stud (parts E and F, Fig. 3) must be flush with the front surface of the left end post. To do this, press the pin into the end plate until the hole is flush with the surface. Be sure the hole in the pin is parallel to the sides of the end post. Then file or grind the pin flush with the back surface of the end plate and fasten to the end post with centerpunch marks around the pin. Now, screw the stud into the end post until the hole is flush with the front surface. The hole in the stud must line up with the hole in the threading pin. Stake the stud in place with centerpunch marks around the stud and file flush.

The friction and lead disc (part C, Fig. 3), must be made from 1 in. dia. drill rod or 1/8x3/4x7/8 in. water or oil hardening tool steel. After drilling and shaping the disc, harden by heating to a cherry red and quenching in cold water. Then polish the piece with emery cloth to expose the bright metal and reheat until the metal turns to a straw color. Again quench in cold water. This method of heat treating applies to drill rod or water hardening steel only. If any other type of steel is used look up the heat treating specification for that type of steel.

The mandrels (part H, Fig. 3), can be made straight and used with the handle (part G), or a handle can be formed by simply bending one end of the wire mandrels. Gas welding rods make excellent mandrels.

To wind an extension spring (Fig. 2), insert the mandrel in the tool so that slotted end extends through the left end post. Move the adjusting blocks up until the mandrel is held against the top of the slots in the end posts and clamp the blocks securely in place with the clamping screws. Then pull the mandrel back until the slot is directly below the hole in the stud screw.

After selecting spring wire of the size you wish to use, thread the wire through the 1/16 in. hole



MATERIAL LIST

No. Req.	Size and Description	Use
1	1/2x3/4x4 1/4" cold rolled steel	base
1	3/16x3/4x2 7/8" cold rolled steel	end A
1	3/16x3/4x2 1/2" cold rolled steel	end B
2	3/16x3/4x7/8" cold rolled steel	blocks D
2	1/8x5/16x7/16" cold rolled steel	blocks D
1	1/8x3/4x1" tool steel	disc C
1	3/16 dia. x 3/8" drill rod	pin E
1	5/16-18 threaded rod 1" long	stud F
1	1/4x1/2x3" cold rolled steel	handle G
6	8-32x5/8" socket hd. cap screw	
2	#8 washers	
	Selection of various diameter welding rods up to 5/16 in dia. for mandrels G	

in the threading pin and stud screw, and into the mandrel slot. Position the friction disc so the straight edge of the disc is horizontal and tighten the stud nut finger tight. Now turn the mandrel handle to wrap a few turns around the mandrel. Again tighten the stud nut this time putting just enough friction on the wire so that the mandrel can be turned without breaking the wire. When the spring is wound to the desired length, cut the wire at the threading pin and keep turning the mandrel until the wire is free. Pull the spring off the mandrel and finish off the spring ends as required.

To form a compression spring, thread the tool with spring wire as before. Rotate the friction disc to give the coil spacing as determined by that section of the disc that is brought in contact with the mandrel. To start the spring push the mandrel forward until the wire picks up the disc bevel. The mandrel will then be pulled through the tool automatically as the handle is turned and the coil spacings will be identical.

With a little practice it is possible to form closed turns on both ends of compression springs. The springs, of course, will always be slightly larger than the mandrel on which they were formed.—C. T. ALLEN.

Lathe Drills Small Holes Accurately

• Precision drilling jobs up to 3/16-in. in diameter can be done on your lathe by combining a pad center and a small toolmaker's vise. Center punch the work at the desired location of the hole and then mount it in the vise. Rest this against the pad and feed the work by advancing the tail stock spindle smoothly.—H. J. GERBER.

King-Size

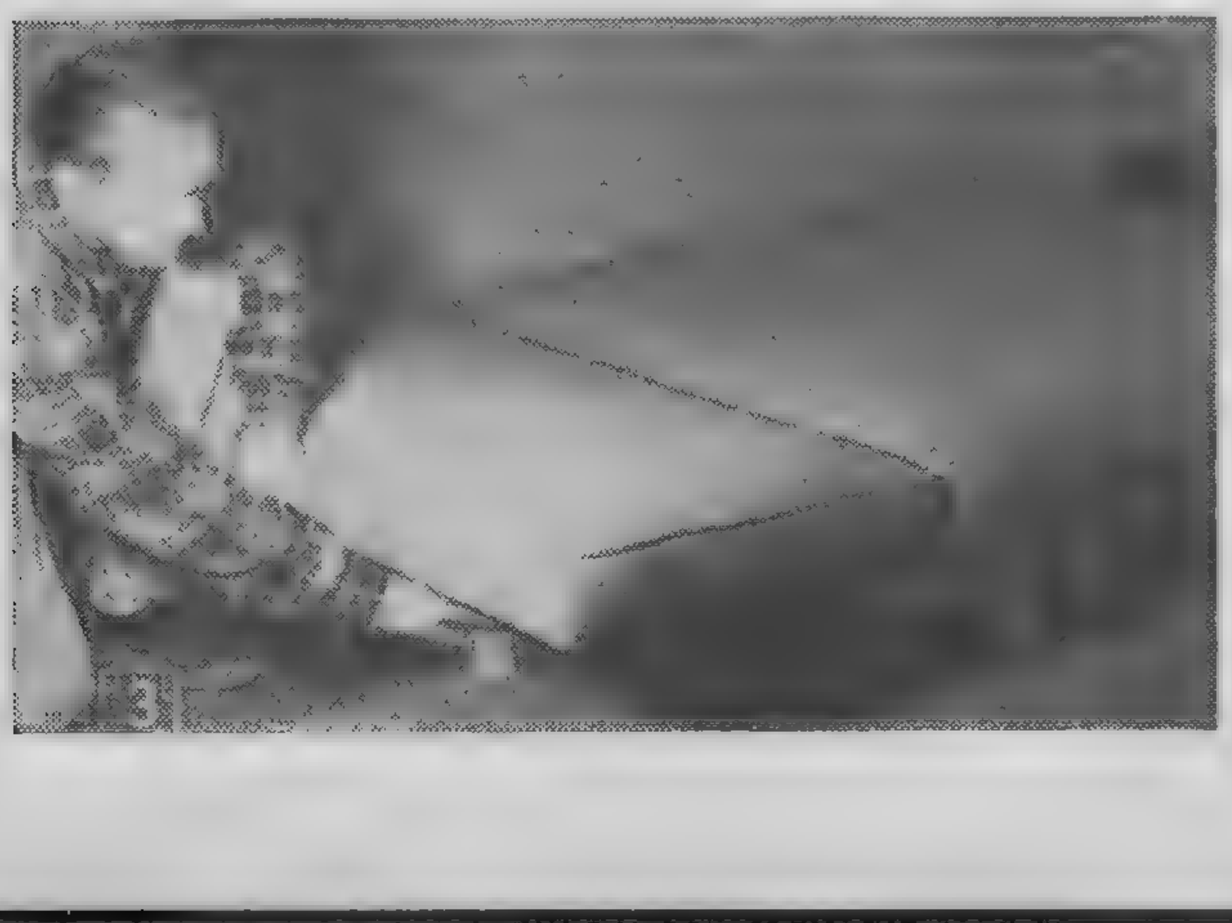
Dad and his favorite helper relaxing comfortably after the job is done. Bottom coil spring unit, 48 in. square, has hinged plywood base entirely concealed by upholstery. Framing side pieces are slotted to hold a detachable high knee support.

Sturdy, movable legs are attached to short fixed legs on frame by dowel pins. They support rear weight of back and bottom units.

CHAISE longue or chaise lounge—take your pick*—the double-width unit in Fig. 1 is designed for a family group to watch television or to read together in any informal area of your home. With a few quick changes, there's an extra bed for a guest (Fig. 3).

This comfortable chair makes a fine Mr. and Mrs. project, as our neighbors found out in their first attempt at upholstering, with Mr. doing framing and assembly and Mrs. the sewing. They chose natural oak for framing and a rose tweed fabric with metallic thread design for the cover, saving $100 over a comparable unit in an exclusive store. You can duplicate it for around $75, depending on wood and cover used. With dark furniture, you may prefer mahogany or walnut framing. For outside use on patio or screened porch, the cover might be an easy-to-clean plastic.

Where room is limited, just modify the



Big seat converts to a bed in a minute through four quick steps. After letting the back down by taking out a dowel pin from each movable leg, high knee support is removed and seat moved a few inches until it meets the back. Two back support blocks are being placed under top back brace to hold the back horizontal.

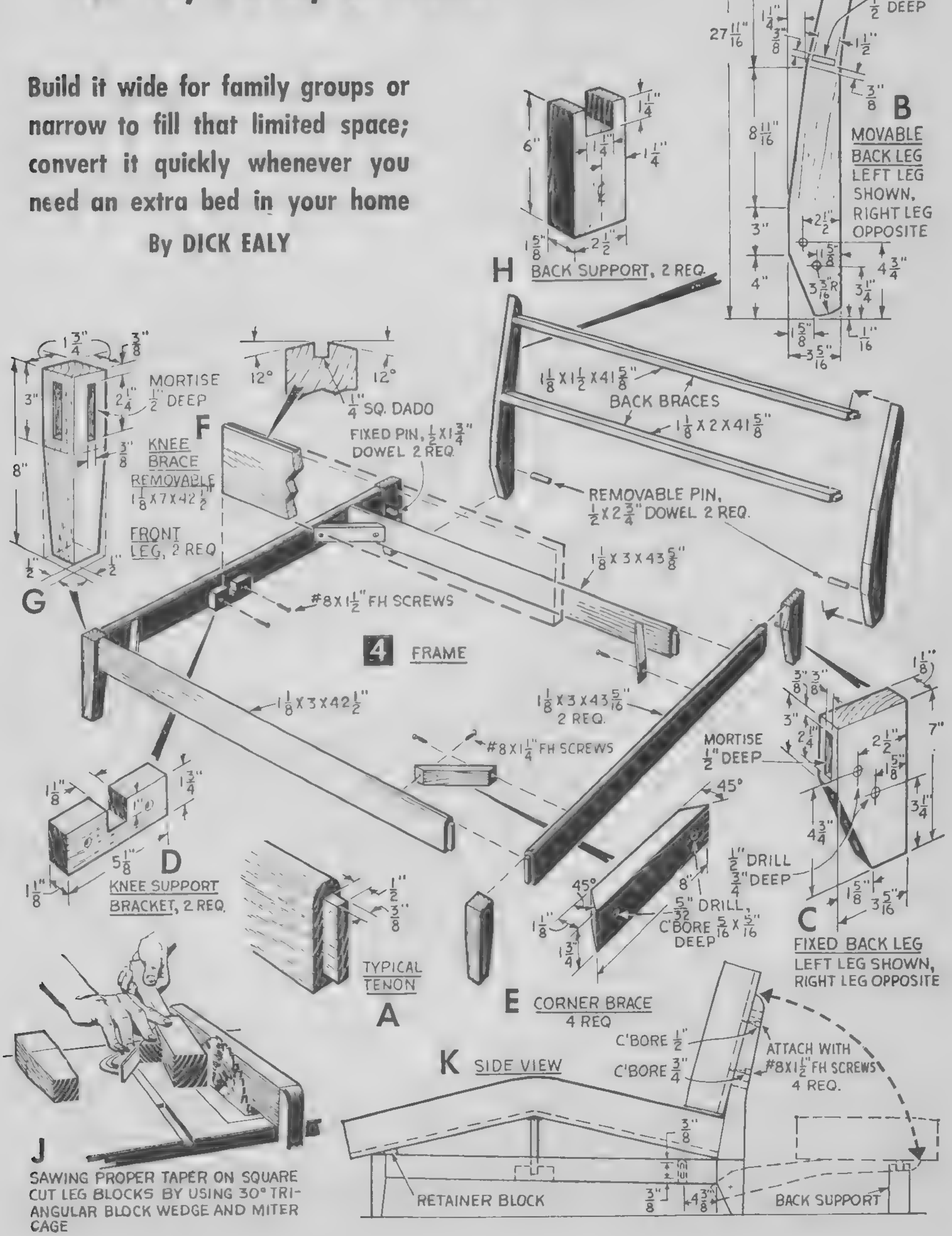
* Technically correct name is *chaise longue* —French for "long chair." Popular American usage has twisted the letters to *chaise lounge* and the meaning to "lounging chair." Either way, it's a nice addition to your home.

Chaise Longue

For TV, Porch, or Patio

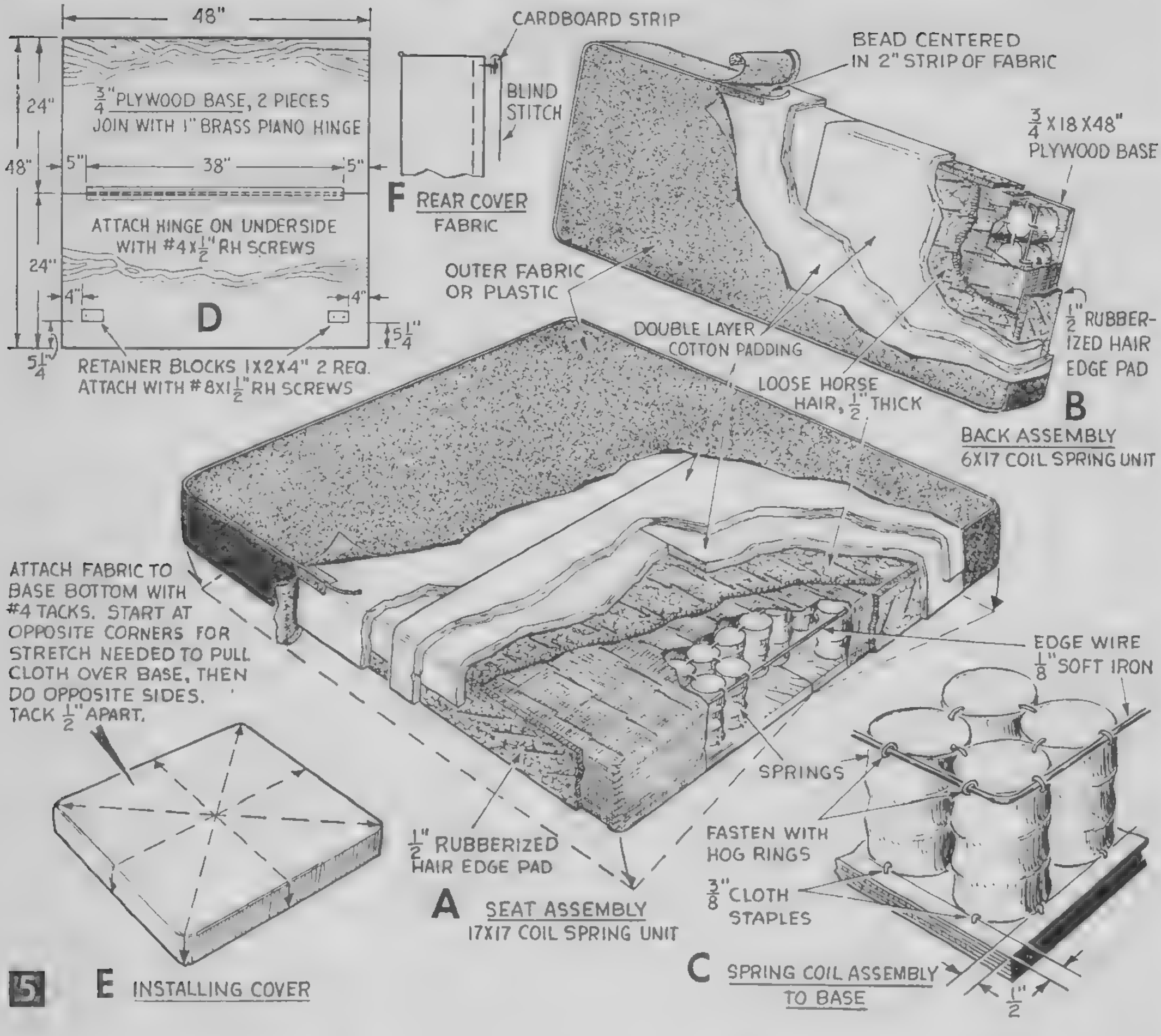
Build it wide for family groups or narrow to fill that limited space; convert it quickly whenever you need an extra bed in your home

By DICK EALY



J

SAWING PROPER TAPER ON SQUARE CUT LEG BLOCKS BY USING 30° TRIANGULAR BLOCK WEDGE AND MITER CAGE



width from 48 to 27 or 30 in., or any multiple of 3. While cost won't go down in proportion, you'll cut it $10 to $20.

Building the Frame. Begin by ripping the front, back, and sides of the bottom frame from the rounded-edge side of half-round door sill stock as in Fig. 4. Rip the back braces next. Cut tenons on each end of the sides and back pieces as in Fig. 4A. To make mortises, use a ⅜-in. drill for a series of holes ½ in. deep, then clean out with a chisel.

Lay out a pattern for the movable back legs by enlarging from the drawing in Fig. 4B. Cut and shape them from the 1⅛-in. door sill stock. Cut, shape, and drill the back fixed legs, knee support brackets, and corner braces as in Fig. 4C, D and E. Cut the removable knee brace, then groove and bevel the top edge as in Fig. 4F.

Taper the front legs from 1¾-in. square hardwood as in Fig. 4G, setting the saw 1/32 in. from the mark and finishing with a disc sander. Cut and shape retainer blocks (Figs. 4K and 5D) and back supports (Fig. 4H), using left-over hardwood or pine scrap. Smooth all pieces with your disc sander on straight edges and a drum sander on the curved edges.

Start assembly by joining the front and back fixed legs to the side pieces as in Fig. 4, using a waterproof glue such as *Weldwood Resorcinol* or *Elmer's Waterproof*. Let this set overnight, then glue on the front and back pieces, check for squareness, and hold with furniture clamps. Glue and screw the corner braces and knee support brackets in place. Assemble the back frame, gluing joints and clamping as before. Join the frames by attaching the movable legs to the rear fixed legs with dowel pins, as in Fig. 4.

If you have used oak or another open-grained wood, brush on a coat of paste wood filler and be sure to rub it in well rather than wipe it off. Let dry 24 hours, smooth with 00 garnet paper, and apply another coat. Then we suggest a clear plastic, varnish, or lacquer to bring out the natural beauty of the wood.

Seat and Back Panels. While waiting for the frame finish to dry, you can begin the upholstered parts. Cut the seat base pieces (Fig. 5D) and the back panel (Fig. 5B) from

a sheet of five-ply ¾-in. plywood.

Turn the plywood seat pieces upside down and fasten with a 38-in. piano hinge as in Fig. 5D. To prevent the seat from sliding forward, attach two retainer blocks as in Fig. 5D. If blocks are more than 1 in. thick, counterbore holes for 1½-in. screws.

Muslin-covered coil springs were chosen for the seat and back (Figs. 5A and B), since they are both comfortable and relatively inexpensive. Have your local upholsterer or mattress company make them up from standard 3½-in. high, 3-in. dia. coils, a 17 x 17-coil unit for the seat and a 6 x 17-coil unit for the back. Attach them to their bases with ⅜-in. cloth staples as in Fig. 5C, slightly compressing coils to be ½ in. from the plywood edge.

Now bend up soft iron edge wire around the top of the springs as in Fig. 5C. These wires come in 16-ft. lengths from the hardware store and must first be straightened. Lap wire ends about 18 in. and place the joint at the rear. Attach springs to the wire with edge wire clips, or hog rings, using pliers.

Begin Upholstering by covering each unit with burlap as in Figs. 5A and 6, attaching it with carpet tacks 1 in. apart to bottom edge of the base. Spread about 4 lbs. of loose horsehair over the top to a ½-in. thickness. Line the edges with ½-in. thick strips of rubberized hair. Sew in place with an upholsterer's loop needle and heavy duty waxed thread, using large 6-in. loops in a single row. Sew the loose hair through muslin and burlap to the springs, in rows 6 in. apart.

Next, lay two pieces of regular 27-in. wide cotton padding side by side over the seat (Fig. 5A), then place two more widths on top

Burlap-covered spring unit ready for horsehair lining.

of that at right angles. This will stick to the hair without sewing.

Seat and back are now ready to cover. Before cutting, remember to allow for a ⅝-in. seam in sewing. Cut the top seat panel 49¼ in. square, then cut and sew together 5⅝-in. wide strips until you have a one-piece side a little over 16 ft. long. Make up the bead, which is upholstering cord sewed into the middle of a 2-in. strip of the fabric. (A sewing machine cording foot attachment will speed this job.) Stitch top and side of the cover together, using the bead material.

Make the back unit cover the same way. Cut a 19¼ x 49¼-in. main piece, then sew it to more bead material and side pieces. Install the covers as in Fig. 5E.

To finish the rear of the back spring neatly as in Fig. 2, cut another 19¼ x 49¼-in. piece of the fabric or plastic, which allows for regular ⅝-in. seams on sides and bottom. Attach it to the top of the back spring base as in Fig. 5F, using tacks and 1/16 x ½-in. cardboard strip 48 in. long. Then bring the fabric down over the cardboard, and blind stitch it to the covering on ends and bottom.

Set the movable rear legs upright and block up the back spring unit just enough to clear seat. Fasten back to the legs as in Fig. 4K.

Insert knee brace in its supports and slide seat in position, with hinge over beveled brace. Now that you've earned a right to test it, see if you don't think your chaise longue is the most comfortable seat in your home.

MATERIALS LIST—KING-SIZE CHAISE LONGUE

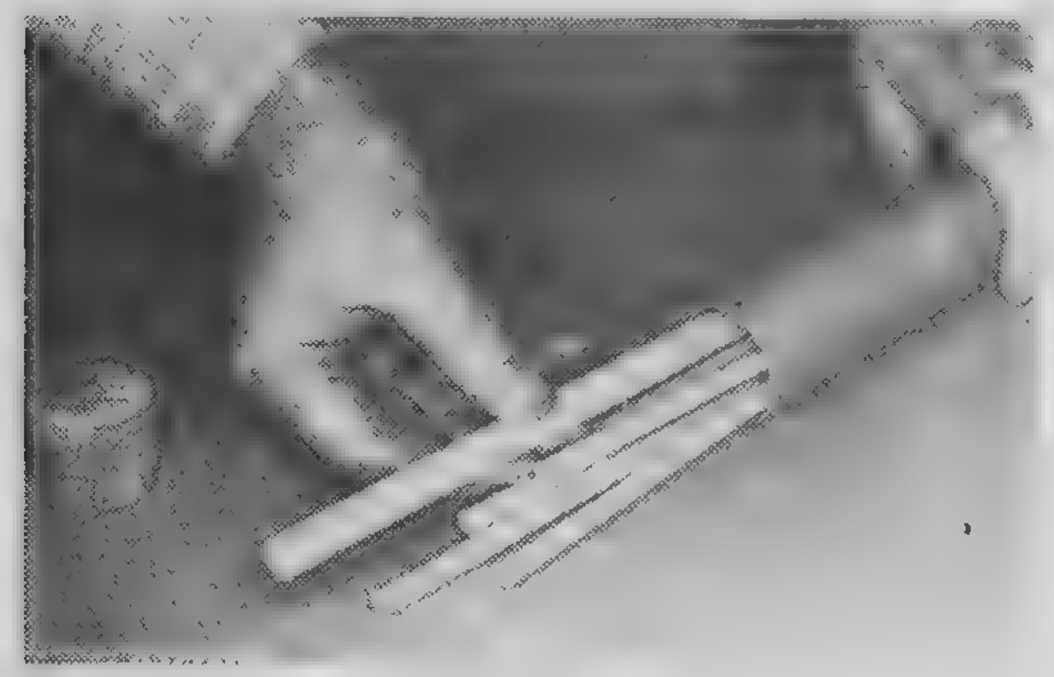
No. Req.	Size and Description
4 pcs.	1⅛ x 11 x 44" oak rounded edge door sill (framing)
1 pc.	1⅛ x 7 x 48" oak (knee brace, retainer blocks)
1 pc.	1¾ x 1¾ x 18" oak (front legs)
1 pc.	¾ x 4 x 8' 5-ply fir plywood (base for seat and back)
1 pc.	½" dia. x 12" dowel (back leg dowel pins)
1	1 x 38" brass piano hinge (join seat base halves—hardware store)
2 pcs.	⅛" dia. x 16' soft iron wire (spring edge wires—hardware store)
4 yds.	54" fabric or plastic covering (drapery, yard goods stores)
1	3½ x 48 x 48" spring with 3" dia., 15-gage coils (seat)
1	3½ x 18 x 48" spring with 3" dia., 15-gage coils (back)
1 pc.	4 x 8' burlap
4 lbs.	loose horsehair
27 ft.	½ x 6" rubberized hair pad
27 ft.	bead cording
	Above 5 materials available at upholstery shops. Springs made to order.
1 roll	1 x 27" x 10 yds. cotton padding
1 ball	waxed finish roll twine
1	4" upholsterer's needle
2 pkgs.	steel edge wire clips
	Above 4 materials available at Sears, Roebuck and Montgomery Ward stores.
8	#8 x 1½" *fh* screws (back unit, knee support)
4	#8 x 1½" *rh* screws (retainer blocks)
8	#8 x 1¼" *fh* screws (corner braces)
32	#4 x ½" *rh* screws (piano hinge)
Misc.	2 boxes ⅜" carpet tacks, box ⅜" cloth staples, waterproof glue, qt. wood filler, qt. clear finish, thread

Used Carbon Paper Makes Layout Dye

• Don't throw away that worn-out carbon paper without using it to make up a supply of inexpensive layout dye. Crumple a few sheets of the carbon paper in a small screw-top jar. Then add two ounces of denatured alcohol and a half teaspoonful of shellac. Lightly tamp the carbon paper at the bottom of the jar to squeeze out the dissolved dye. Test the dye on bright metal and add more carbon paper as necessary to get the desired shade.—C. G. Sykes.

Avoiding Loose Dowel Joints

Moisture picked up in a damp location can make dowels swell enough so you have to dress them down to match the diameter of the holes you plan to use them in. When the moisture content returns to normal, the dowels will then



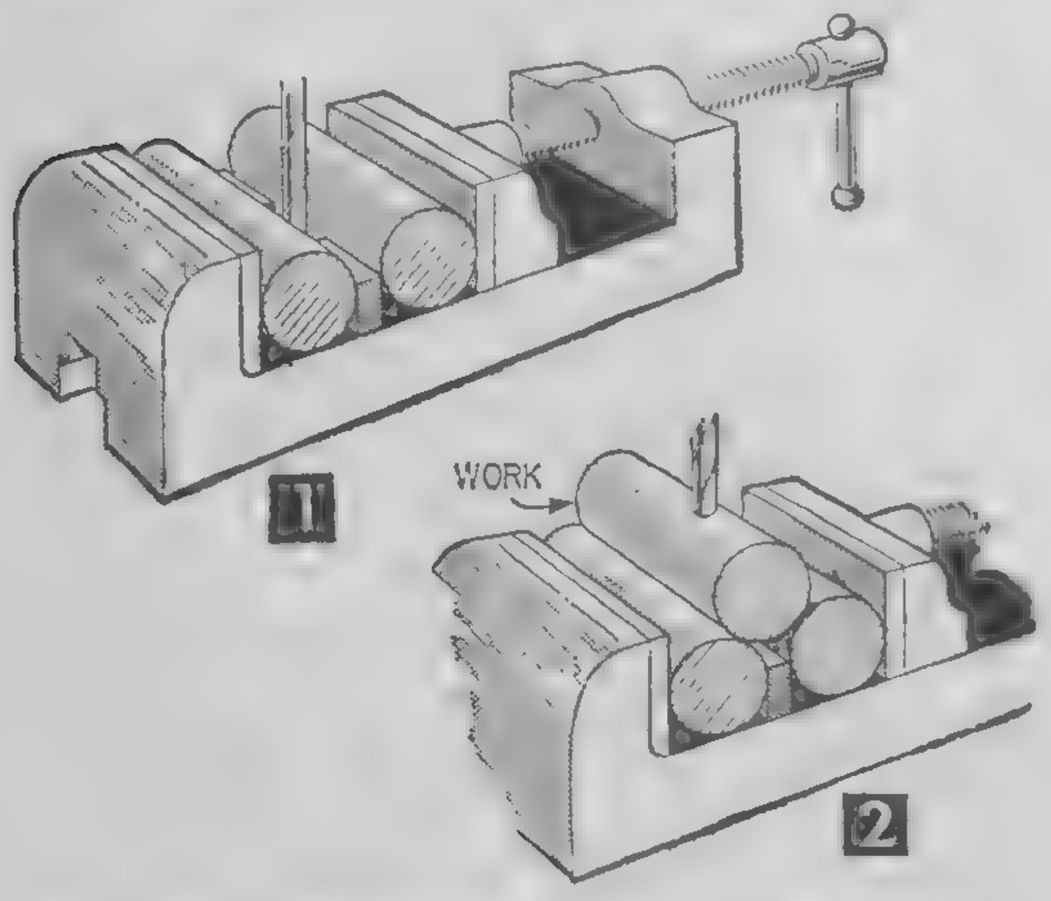
Label the tubes (you can use those that calendars come in) so you can tell at a glance the diameter and length of the dowels therein.

shrink, causing a loose joint.

To avoid this problem, store your dowels in a cardboard mailing tube, available at stationery stores. Seal one end of the tube with a wood plug and close the other end with a cork or tapered wood stopper. You can keep several of these tubes on hand to accommodate dowels of varying lengths.—F. HEGEMEYER.

Improvised V-Block Centers Drill Bit for Round Stock

To cross-drill round work through its exact center on a drill press, clamp two flat steel blocks, of the same thickness as the diameter of the drill, between two short lengths of round bar



stock, thus improvising a V-block as in Fig. 1. Center the drill by lowering it between the bar stock and clamp the vise to the drill press table. Place the work on the V-block, Fig. 2, and drill the hole.—C. W. WOODSON.

Shop Kinks

Dowel Turned Without Center Rest

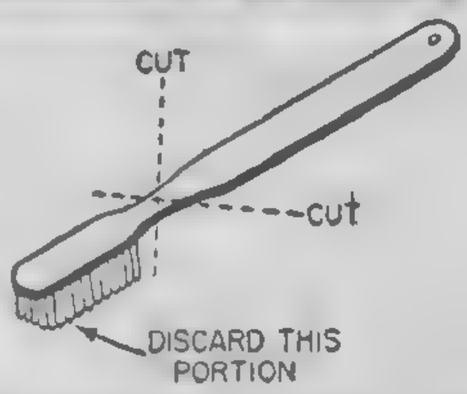
• To turn dowel rods to be cut into fine moldings, without a center rest, make a metal guard to slip on the chisel, with two prongs bent up to ride on top of the rod. Place one hand, with a bit of sandpaper, over the work. You can turn the entire rod without chattering. Molding plane bits make good cutters. Shape them to make the style molding you want. Rip the completed stick into flat molding quarter round or three-quarter round.

How Many Board Feet?

• To determine the number of board feet in a piece of lumber multiply the thickness by the width (in the rough), divide by 12 and multiply by the length. Thus a 2-by-6 12 ft. long contains 12 board feet.

Toothbrush Handle Strings Along

• The handle of a discarded toothbrush containing a hole for hanging makes a handy tool for threading a drawstring or ribbon through a laundry or duffle bag and clothing, and may even be used as a fish stringer. Cut handle off at the narrowest point, sand and then buff to a smooth finish.—A. ZANELLI.



Dry-Sawing Plastics

• The dry-sawing of acrylic plastics such as plexiglas or lucite is considerably improved by applying tallow, wax, or brown laundry soap to blade or line of cutting to reduce frictional heat which often results in resealing of the saw kerf, especially with fine blades on jigsaws.

With circular saws this application promotes free cutting of plastics ⅜ in. thick and over. For heavy cuts, hollow-ground combination saws with four cutting teeth alternating with one cleaning tooth, well-conditioned, and projecting considerably above the work, are preferred. Material over ½ in. should be sawed in two or more passes when all these conditions are not present.—JOHN P. ARNOLD.

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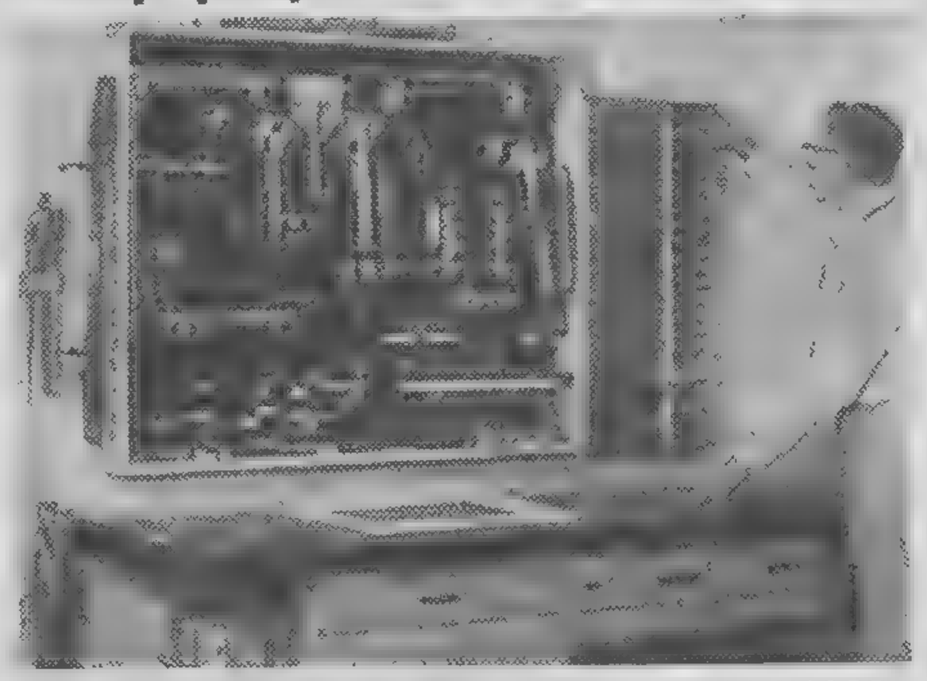

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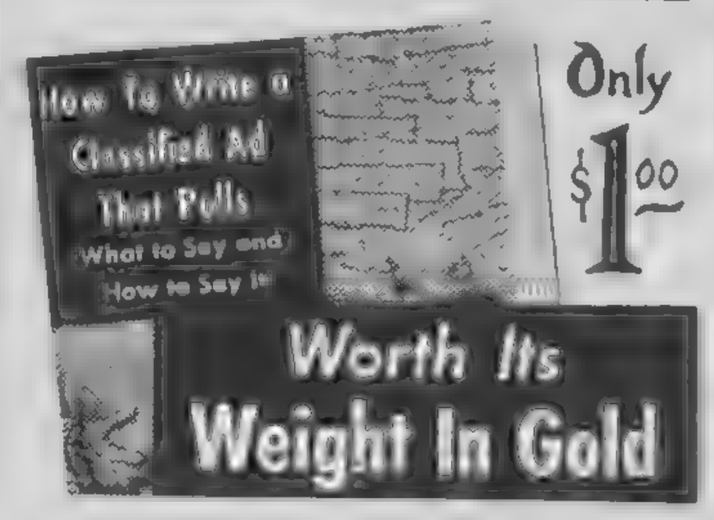

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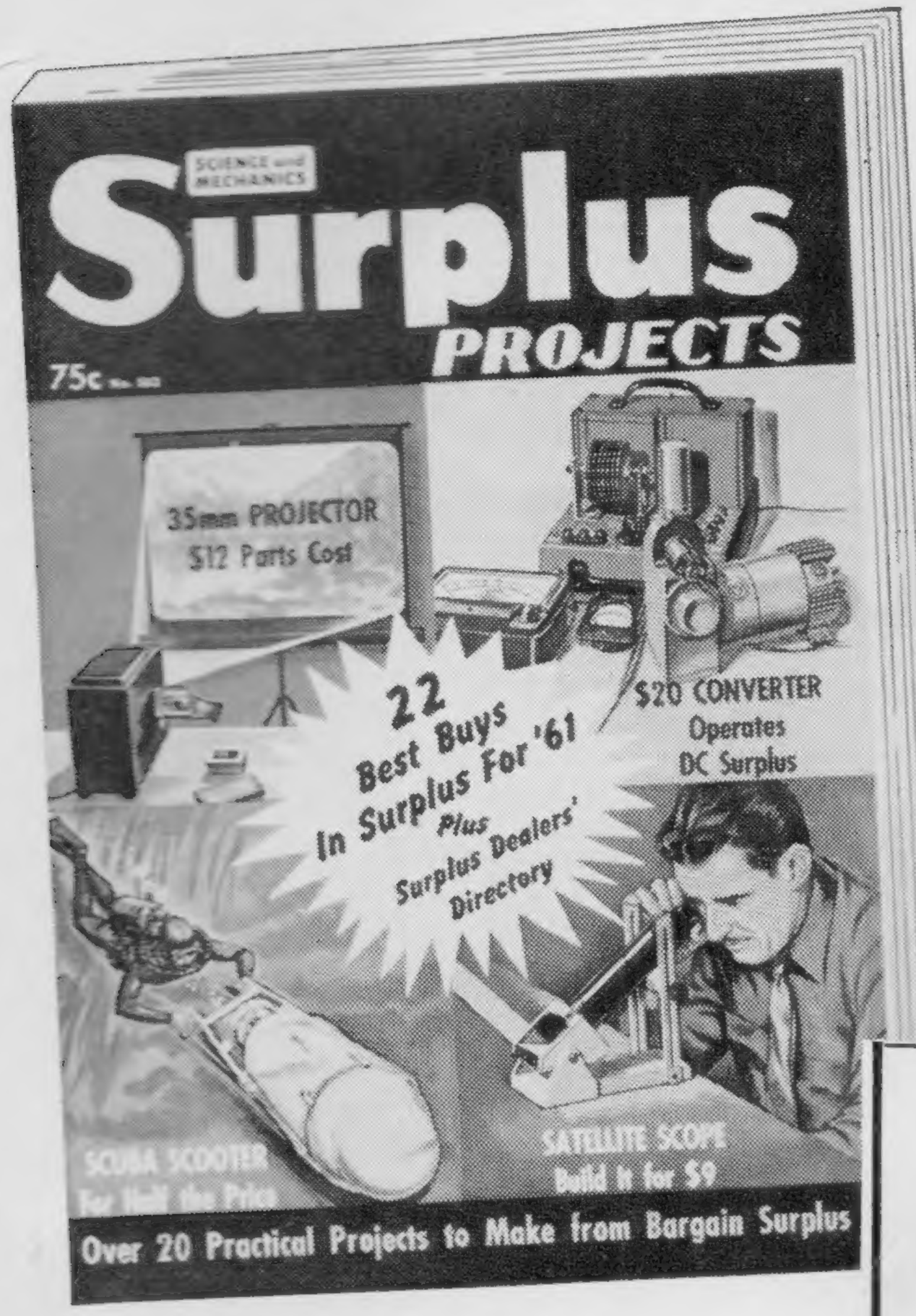

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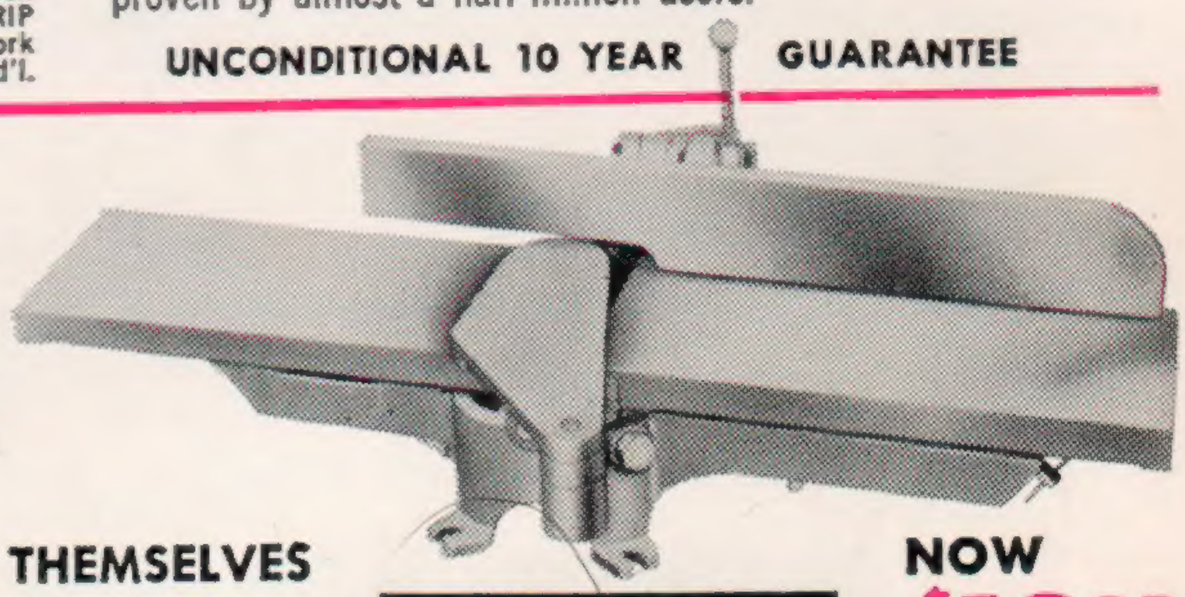

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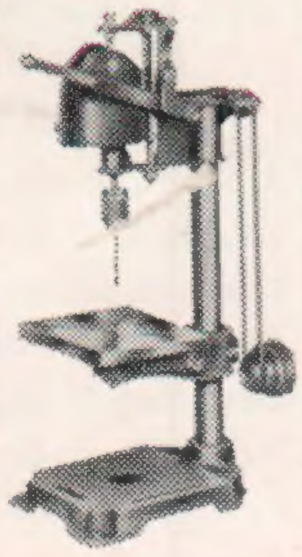

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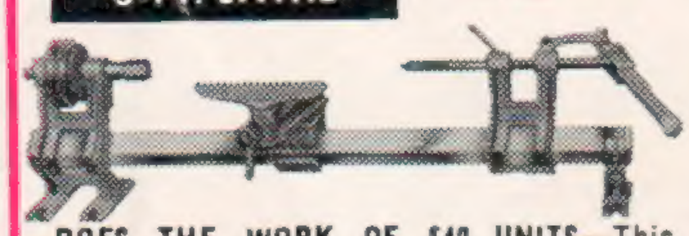

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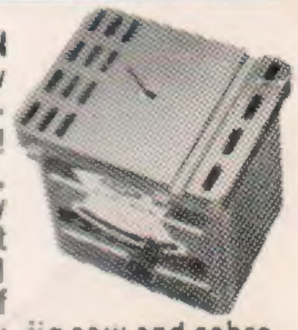
Complete as shown

Wt. 16 lbs. Exp. Coll.

NEW! HIGH SPEED 5-IN-1 SAW



CUTS THRU 2 x 4's IN 5 SECONDS! New machine revolutionizing home workshop! Cuts circles, curves, straight lines, any angle 0°-45°. Tilt arbor bench, 5-IN-1 saw does most work of band saw, circular saw, jig saw and sabre saw . . . with all their desirable features, none of their shortcomings . . . and at less than half the price. There's nothing else like it! Comes with ground cast iron table top, HEAVY DUTY 6000 RPM UNIVERSAL MOTOR. Unique "hand saw" blade action clears teeth on each up-stroke, eliminates lift-up of work. UNCONDITIONAL 10 YEAR GUARANTEE.

$29.95 MOTOR INCLUDED

Wt. 18 lbs. Exp. Coll.

MAIL COUPON TODAY!

American Machine & Tool Co., Dept. HW-9, Royersford, Pa. ☐ Send 8" Saw at $9.95. ☐ Incl. Rip Fence at $3.50 (both for $13.45). ☐ Send Jointer-Planer at $19.95. ☐ Send 5-IN-1 Saw at $29.95. ☐ Send Lathe at $9.85. ☐ Send Drill Press at $19.95. ☐ Payment in full enclosed $..... or ☐ $3 dep. ea. item enclosed, balance C.O.D. I MUST BE FULLY SATISFIED OR WILL RETURN WITHIN 10 DAYS FOR FULL REFUND, no questions asked.

NAME.....

ADDRESS.....

CITY.....ZONE.....STATE.....

(please print)

10 DAY MONEY BACK GUARANTEE

You must be satisfied or money refunded, no questions asked.

AMERICAN MACHINE & TOOL COMPANY

Dept. HW-9, Royersford, Pa.